

Smart Cities

Omar Selim







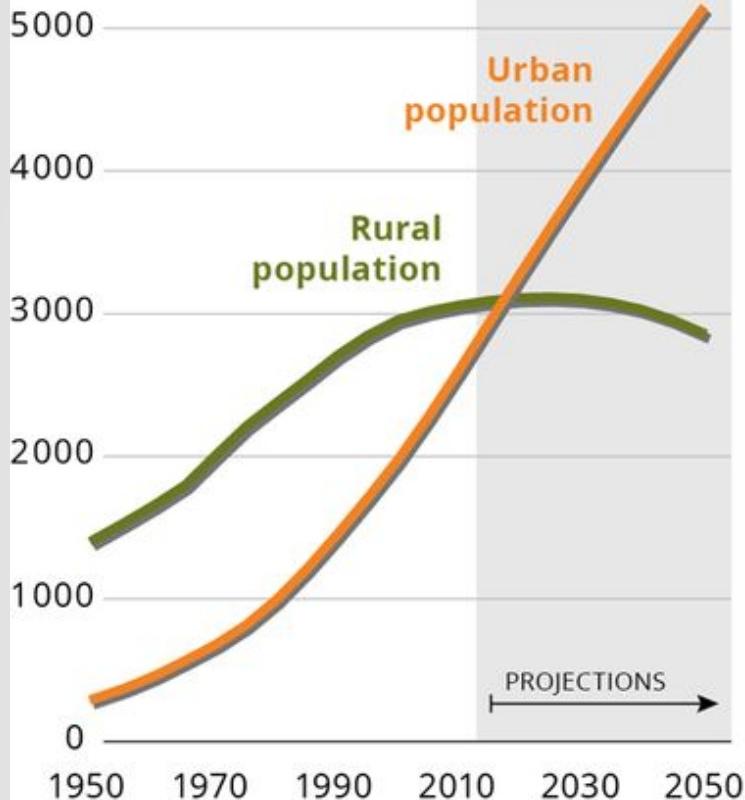
68% of the world population projected to live in urban areas by 2050, says UN.



Less developed regions

Africa, Asia (excluding Japan), Latin America and the Caribbean, Melanesia, Micronesia and Polynesia.

Millions

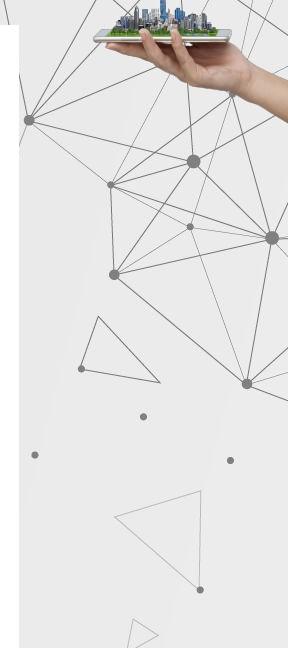
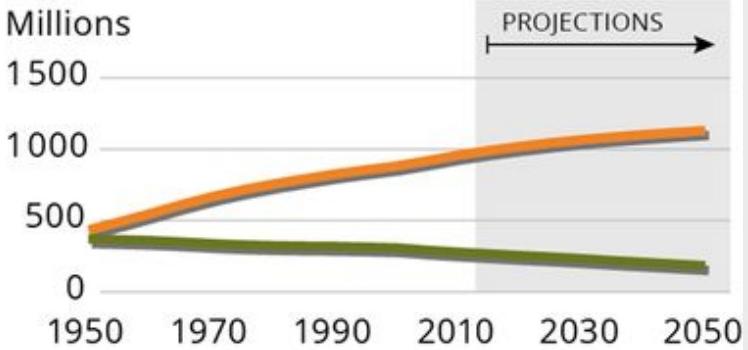


PROJECTIONS

More developed regions

Europe, Northern America, Australia, New Zealand and Japan.

Millions



Why cities need to become smart now

In **1960**, the **global population** around **3** billion

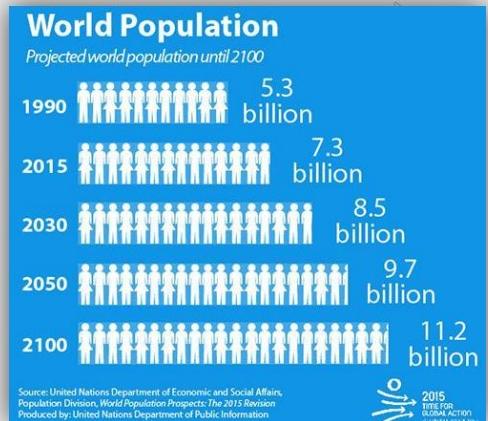
The World Bank puts the **2016** population at **7.44** billion – a rise of almost **146%** in just **56** years

According to the Swiss-based international standards agency, International Electrotechnical Commission (IEC),

*“every day, urban areas grow by almost **150,000** people, either due to **migration or births**”.*

A dramatic **rise in demand** on resources, from food and water through to energy, space, and clean air.

cities that were designed for yesterday's populations, using yesterday's technologies are **beginning to buckle** under the strain of **meeting the needs** of today's never-envisioned populations.





Why cities need to become smart now

33 megacities with more than ten million inhabitants)

The challenge will be to supply these populations with basic resources like safe **food**, clean **water** and sufficient energy, while also ensuring overall **economic**, **social** and **environmental** sustainability.



According to the World Health Organization's Global Health Observatory ([WHO GHO](#)), **ambient air pollution** contributes to **5.4% of all deaths**.

Currently, **92% of the world's population** lives in **places where air quality exceeds WHO guideline limits**.

promises modern cities must fulfil if they are to stay competitive and provide a decent **quality of life to their citizens**:-

Sufficient fresh **water**; universal access to **cleaner energy**; the ability to **travel efficiently** from one point to another; a sense of **safety and security**;



What are smart cities?

Smart cities are new cities specifically designed and built to capitalize on **the full potential of technology**

to both address **difficult issues** traditionally associated with: large urban development, including sustainability, congestion, transport and energy use,

while at the same time **improving the quality of life** for inhabitants through benefits such as :

quicker access to healthcare, more integrated transport and less pollution

- Better Planning & Economic Growth
- Less Pollution and Reduced Energy Consumption
- Better and Faster Infrastructure
- Less Commuting & Better Transportation Systems
- Reduced Traffic Accidents
- Better Crime Control
- Responsive Government Action
- Cost-Efficiencies & Competitiveness



Source : Do we really need smart cities? TechRadar, 20

March 2016

Definitions and overviews, Smart Cities Council, accessed April 2018



The Smart Cities Council, a network of leading companies advised by top universities, laboratories and standards bodies, says: "*The smart city sector is still in the 'I know it when I see it' phase, without a universally agreed definition.*"

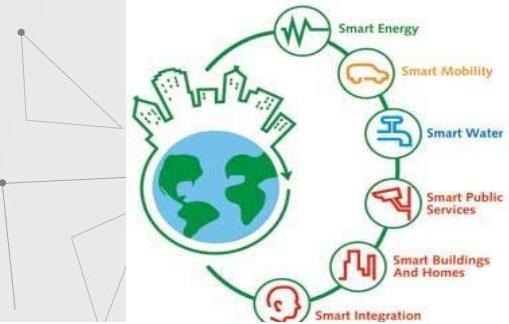
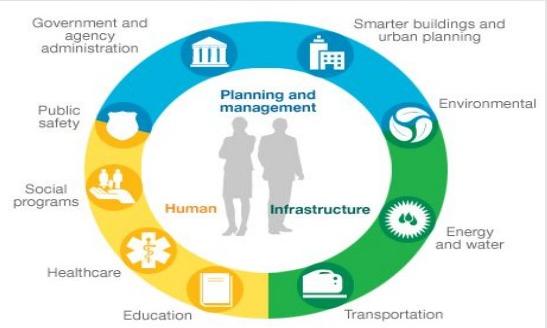
as one that has **digital technology embedded across all city functions**.

a "process, or series of steps, by which cities become more 'livable' and resilient and, hence, able to **respond quicker** to new challenges."

according to a UK government smart cities report

Smart Cities Definition.

. In year 2007, Prof Rudolf Giffinger of Vienna University of Technology formally coined the term “Smart City” Smart City uses technology and ICT to better quality & performance to engage more effectively and actively with its citizens. The Smart City includes government services, transport, traffic management, energy, health care, water and waste.



The Definitions of Smart Cities

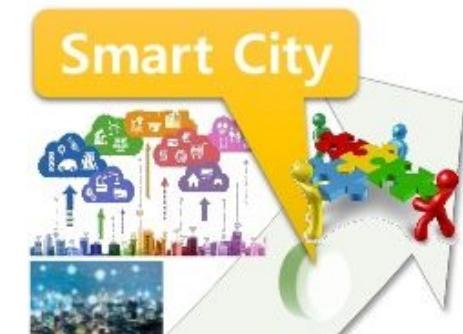
Division	Definition
Ministry of Land, Infrastructure and Transport	Future city that utilizes cutting-edge ICT for all urban resources such as human resources, environment, energy, transportation, and urban infrastructure to realize continuous economic development and quality of life
ITU	Smart Sustainable City is an innovative city that uses ICT to improve the quality of life, the effectiveness of city operations and services , and competitiveness. This ensures the needs of present and future generations in economic, social, environmental and cultural aspects.
IBM	A city that can collect, analyze, and integrate information using ICT, which is the key to the core system to operate the city.
Hall(2000)	A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens
Smart Cities Council	City using IT and ICT to improve livability, workability and sustainability

smart city services

	Traditional city	Smart city
Infra-structure	2-dimensional city	3-dimensional city
Operation	Mechanical	Creative
Services	City-centered	Citizen-centered
	Process-based	Data-based



Traditional City



	Smart City Services
Transport /Logistics	<ul style="list-style-type: none"> Intelligent Safety Management System for subway/rail/bus Smart Crosswalk Autonomous Car / Smart Parking Traffic Information Collection and Bypass Road Guidance Traffic/Cargo Traceability
Environment	<ul style="list-style-type: none"> Air Quality Management System Subway Vent Management System Smart City-Environment Management System
Energy	<ul style="list-style-type: none"> Smart Building Energy Save System Electric Car Charging Station Smart Store Energy Management
Safety	<ul style="list-style-type: none"> Smartcity Disaster Prevention System Safe Driving Alert System Smart anti-kids-lost services Smart Traffic Safety Services in School Zones Socially Underprivileged Security Services
Healthcare	<ul style="list-style-type: none"> Medicines and Medical Devices Management System
Food Services	<ul style="list-style-type: none"> Food Safety Systems Disclosure / Tracking / Recall Service



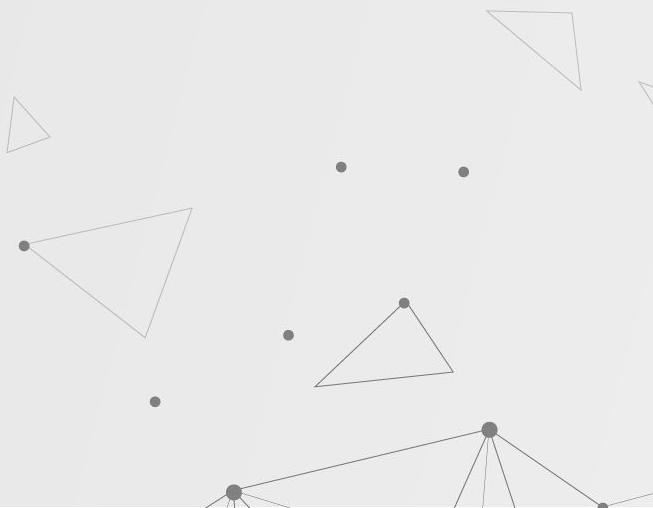
SMART CITY

BUILDING TOMORROW'S CITIES





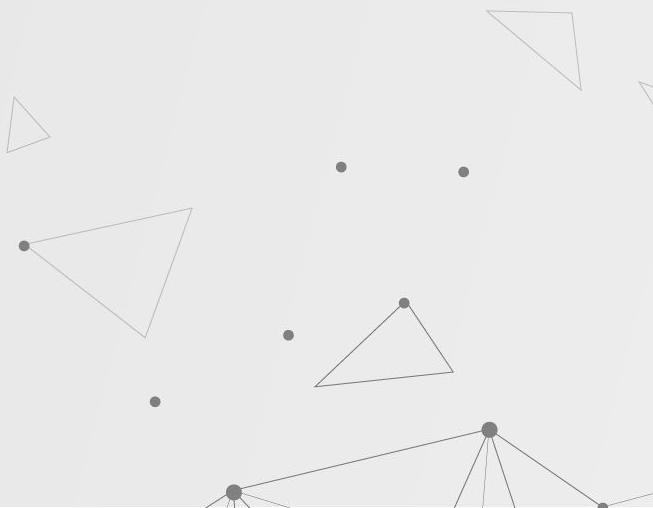
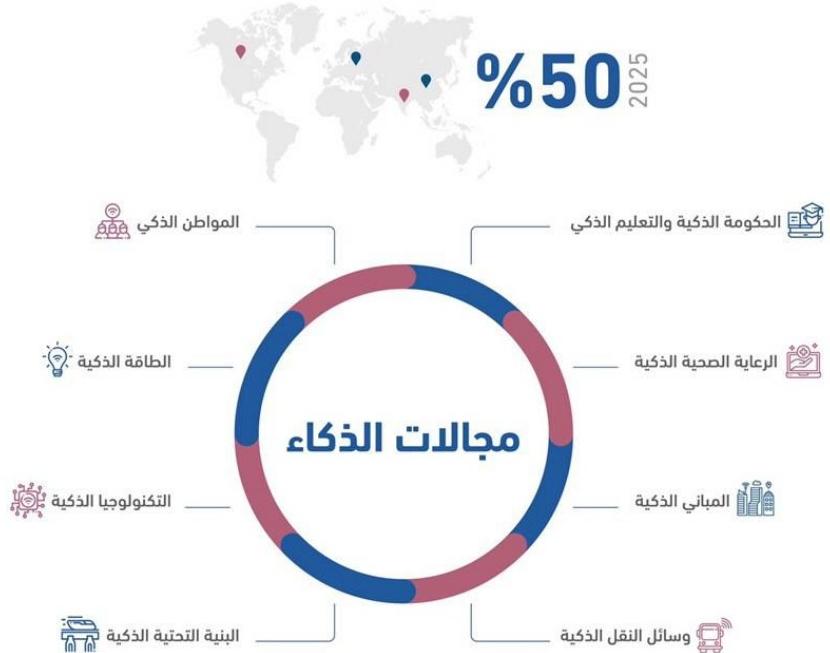
مكونات المدينة الذكية





مستقبل المدن الذكية

وفقاً لـ Forst & Sullivan فإن أكثر من 40% مدينة عالمياً ستُصبح مدن ذكية في عام 2020 وأكثر من 50% من المدن الذكية لعام 2025 ستكلو من أوروبا وأمريكا الشمالية والصين والهند



Mixed-modal access

Clean & non-motorized option

Integrated ICT

Culturally vibrant & happy

Safe

Healthy

Enabling supply & demand size policy

Transparency & open data

ICT & eGov

Smart Mobility



Smart People



Smart Living



Smart Economy



Smart City



Smart Government



Smart Environment



21st Century Education

Inclusive society

Embrace Creativity

Entrepreneurship & innovation

Productivity

Local and global interconnectedness

Green buildings

Green energy

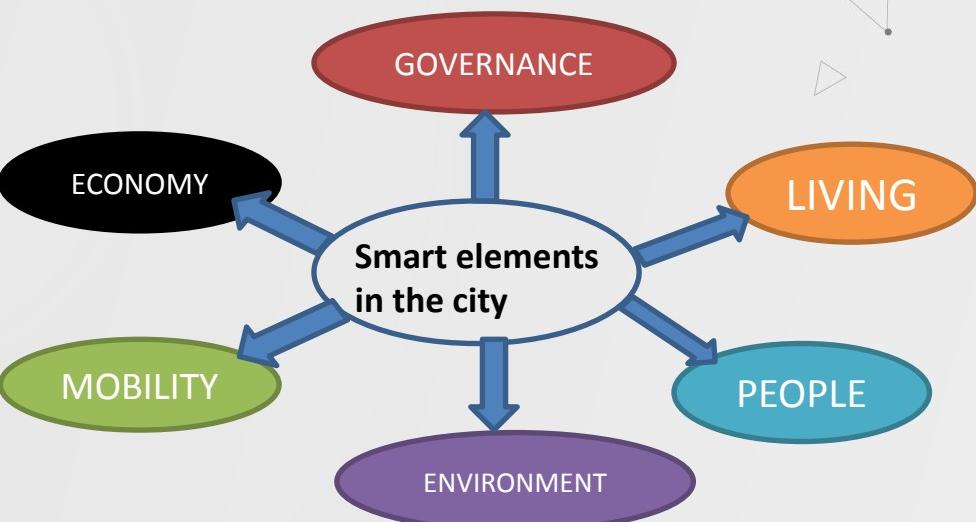
Green urban planning



SEVEN SMART CITY PILLARS

Bhubaneswar has identified seven smart city pillars which align the citizen's aspirations and needs with city systems.

- 1.
2. City planning and design
3. Urban utilities (water, smart waste management, sanitation and waste water management, energy, and ICT / IT connectivity)
4. Shelter, with a focus on inclusive housing
5. Economic development, economy and employment
6. Social development, including identity and culture, education, health, open spaces, safety and security, and air quality





Mobility

Urban mobility, including street design
and public transport

Vehicles

- intermodality
- vehicle sharing / pooling
- low environmental impact
- non-motorized transport

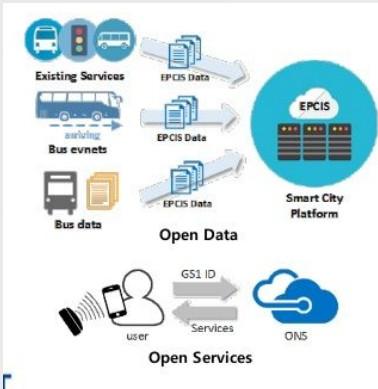


Infrastructure

- road networks and intelligent traffic lights
- monitoring and controlling
- for electric vehicle
- Infrastructure
- communication V2V, V2I

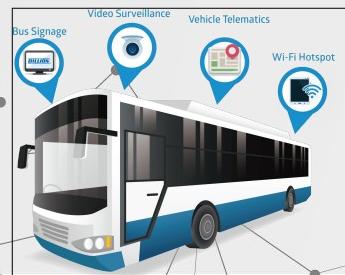
People

- sharing information
- emergency management
- security



Service

- fleet management
- freight logistics
- electronic payment systems





Inclusion

Education / Training

- evolution of educational paradigms
- learning tools for disabled
- inclusion for foreign students
- training for immigrants
- professional training for unemployed

Social Communication

- neighborhood level and social support
- volunteering support
- Integration / involvement of unemployed
- contrast to the immigrants isolation



Government

- e-administration
- e-democracy
- e-participation
- Governance, including citizen participation and intelligent government services

Assistance

- Moving autonomy for disabled
- monitoring the elderly & promoting healthy lifestyles
- security and emergency management for frail people

Life & Health



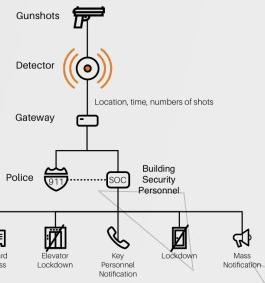
Environment and Territory

- waste / water management
- environmental quality analysis
- Territory monitoring
- territorial planning
- disaster prevention
- Infrastructure monitoring



Security

- night urban surveillance/prevention and fighting crime
 - monitoring and managing of Big events
 - public order management
 - security for moving users
- Gunshot Detection Technology



Culture and Tourism

- promotion of cultural heritage
- conservation and upgrading of assets
- promotion of tourism

Accessibilità

- to the structures / usability
- to the cultural resources of the city



Energy

Buildings

- Consumption monitoring
- Plant automation / energy saving systems
- Interfacing with energy networks
- Interfacing with Renewable Energy Sources



Infrastructures

- smart grid
- smart heating/cooling networks
- Support for vehicular networks (electric recharge)

People

- interactions between man and building
- saving energy awareness policies
- community management (e.g. at condominium level)

Vehicles

- low impact vehicle
- driving style (eco-driving)
- travel planning (eco-routing)



How to implement and support the strategy



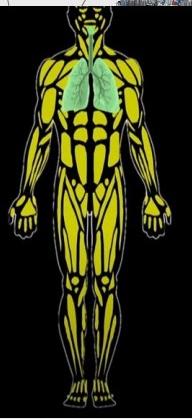
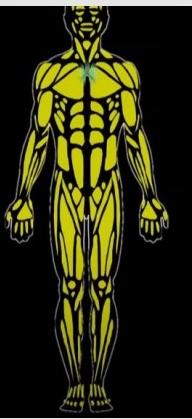
- **SMILE** cannot be separated by considerations of **economic sustainability**, in order to:

- better address the resources and avoid investments incorrect or counterproductive
- Reduce the risk of sanctions
- Better focus the main objectives, taking into account options for long-term sustainability



- Public-private partnership, pre-commercial procurement of innovation
- National R&D Projects and EU (Horizon 2020)
- Rules and regulations to support the dissemination of developed solution

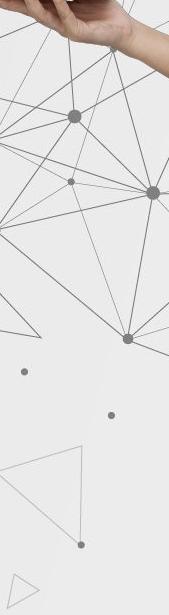




<https://apps.london.gov.uk/greener-city/#14.88/51.45081/-0.01014/0/4>

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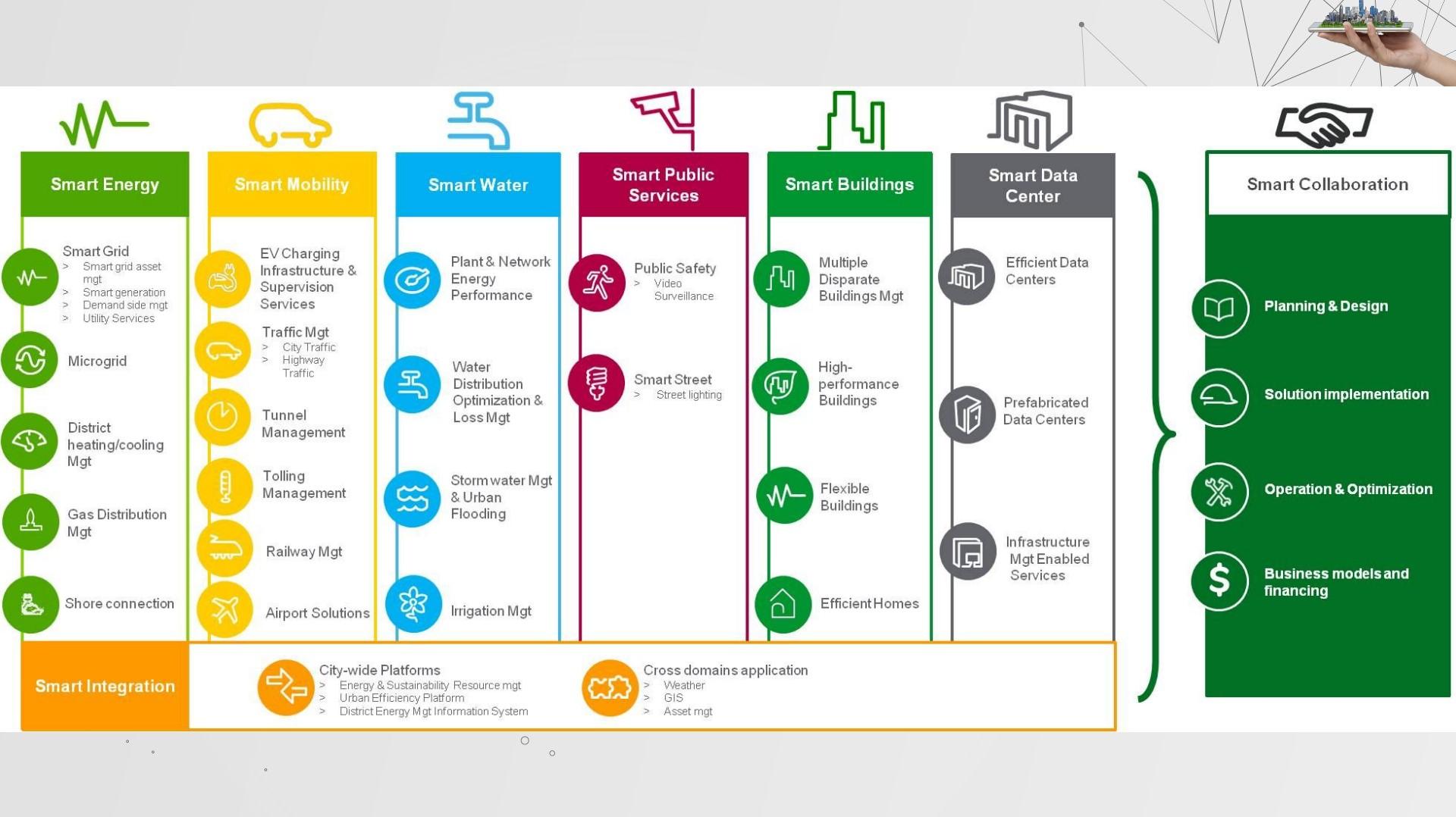




How will we better plan, design, construct
and operate our cities and infrastructure in
a more sustainable way for the future?

We must Change our Ways





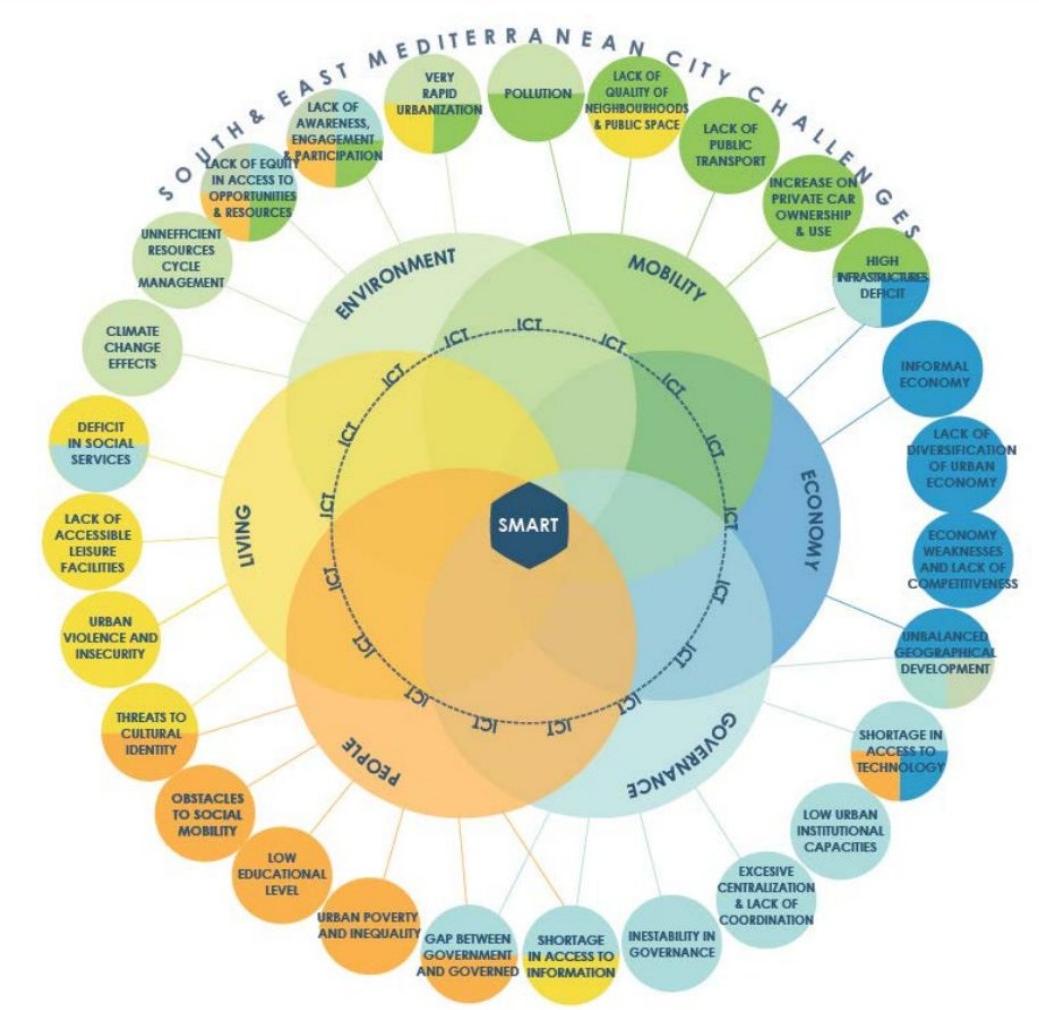
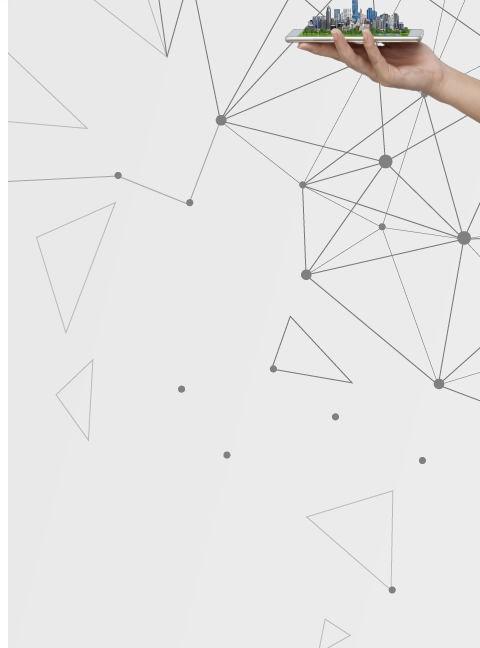


Figure 2. South & East Mediterranean City challenges correlated with Smart City dimensions





SMART CITY



Ubermetrics

... fueled by a combination of disruptive technologies and social innovations ...

Most new technologies and social innovations are disruptive on their own. The combination of them is even more powerful and creates a 'perfect storm' of disruption.



Smart City Capability Framework

Successfully building a smart city requires a clear strategy and maturity in seven capability dimensions.



Goals



Economic growth



Quality of life, a good city to live in



Ecological footprint, sustainability

Challenges



Social cohesion, inclusiveness



Secure digital environment, privacy



Resilience



Smart Mobility



Smart Safety



Smart Energy, Water & Waste



Smart Buildings & Living



Smart Health



Smart Education



Smart Finance



Smart Tourism & Leisure



Smart Retail & Logistics



Smart Manufacturing



Smart Government



SMART CITY USE CASES



SMART
PARKING



WEATHER
SENSORS



DIGITAL
SIGNAGE



ACOUSTIC
SENSORS



WATER & GAS
METERING



TRAFFIC
LIGHTS &
CONTROLS



ELECTRIC
VEHICLE
CHARGING



SOLAR
INVERTERS



SECURITY AND
SURVEILLANCE



WASTE
MANAGEMENT

Smart Solutions

E-Governance and Citizen Services

- ① Public Information, Grievance Redressal
- ② Electronic Service Delivery
- ③ Citizen Engagement
- ④ Citizens - City's Eyes and Ears
- ⑤ Video Crime Monitoring



Waste Management

- ⑥ Waste to Energy & fuel
- ⑦ Waste to Compost
- ⑧ Waste Water to be Treated
- ⑨ Recycling and Reduction of C&D Waste



Water Management

- ⑩ Smart Meters & Management
- ⑪ Leakage Identification, Preventive Maint.
- ⑫ Water Quality Monitoring



Energy Management

- ⑬ Smart Meters & Management
- ⑭ Renewable Sources of Energy
- ⑮ Energy Efficient & Green Buildings



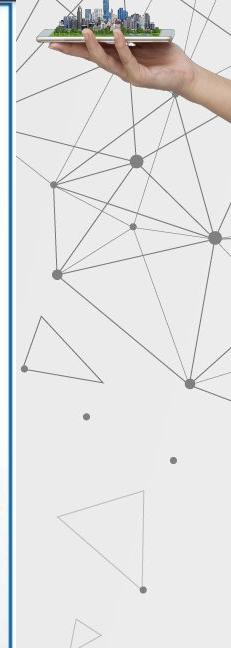
Urban Mobility

- ⑯ Smart Parking
- ⑰ Intelligent Traffic Management
- ⑱ Integrated Multi-Modal Transport



Others

- ⑲ Tele-Medicine & Tele Education
- ⑳ Incubation/Trade Facilitation Centers
- ㉑ Skill Development Centers



Changing our Ways

Old Way

Analog
Silos
Reactive
Error Prone
Disconnected
2D Paper Drawings

New Way

Digital
Collaborative
Proactive
Predictable
Interoperable
Intelligent 3D Models



**We must build and share Smarter Models in a
smarter way**

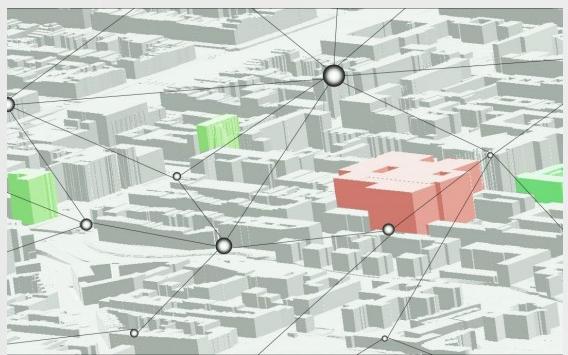
GeoBIM = integration of geoinformation with BIMs

3D geoinformation:

3D city models

+ Building Information Models

1. Integration of data (common characteristics, they fit together)
2. Data interoperability
3. Reliable conversions BIM « GIS
4. Integration of procedures (BIM and GIS (Geographic Information System) tools)



GEO world point of view

- High level of detail 3D cadaster
- No tasks duplication (3D data collection)
- Efficient databases updates without additional costs
- Effective data exchange with professionals (architects, engineers, environmental scientists, etc.)
- Stronger information for lifecycle asset management & city analysis



BIM world point of view

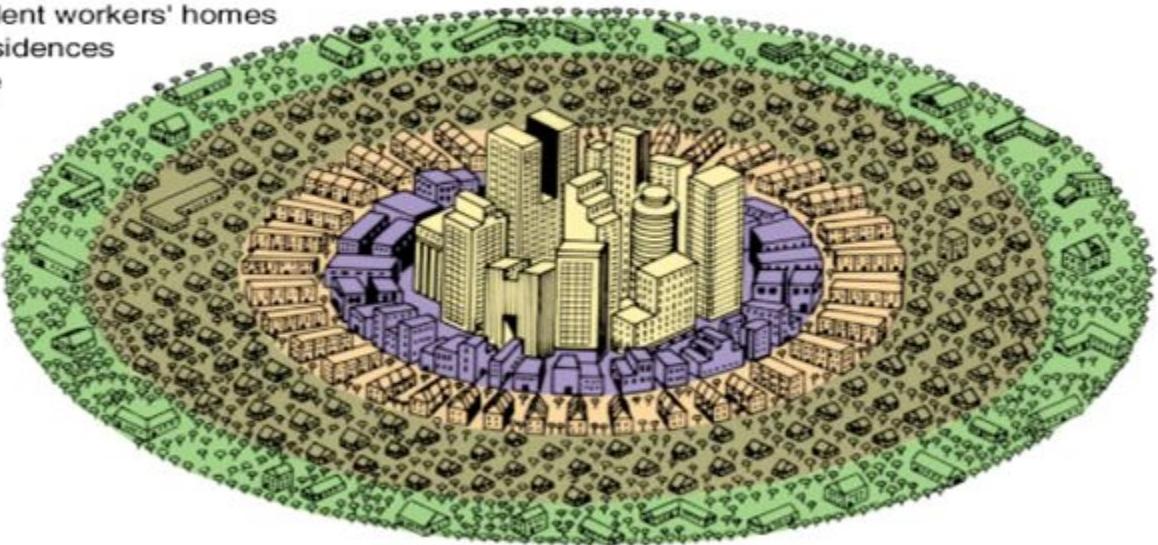
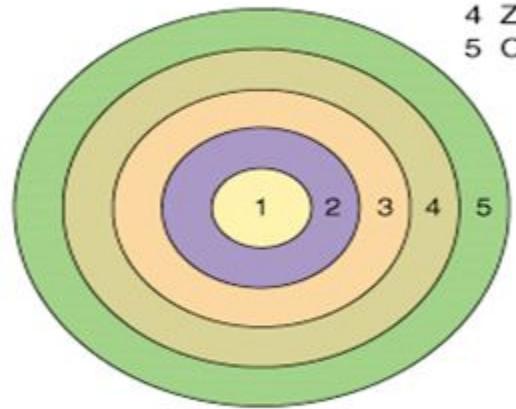
- Context for design reference
- Improved test of building properties: designed building into its context
- Test of the impact of the building on the city or landscape.
- Multiscale vision (from construction elements to whole territories)



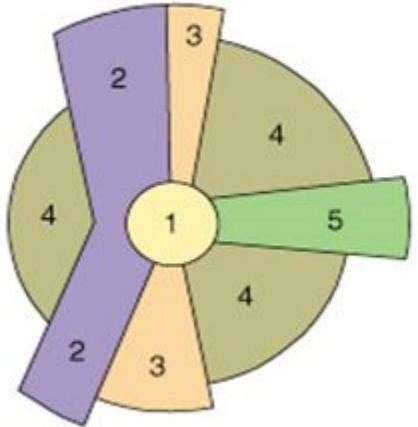
Modeling Cities:concentric zone model



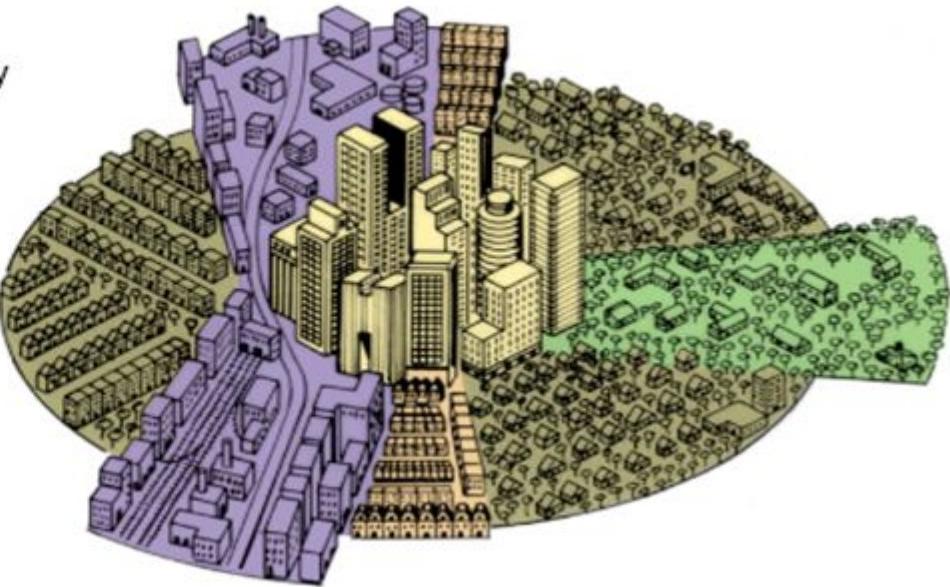
- 1 Central business district
- 2 Zone of transition
- 3 Zone of independent workers' homes
- 4 Zone of better residences
- 5 Commuter's zone



Modeling Cities:sector model



1. Central business district
2. Transportation and industry
3. Low-class residential
4. Middle-class residential
5. High-class residential



- Stresses the importance of transportation corridors. Sees growth of various urban activities as expanding along roads, rivers, or train routes.



"You want to be able to monitor, measure, and control your services & assets to gain better outcomes for people"



Air Quality Sensor



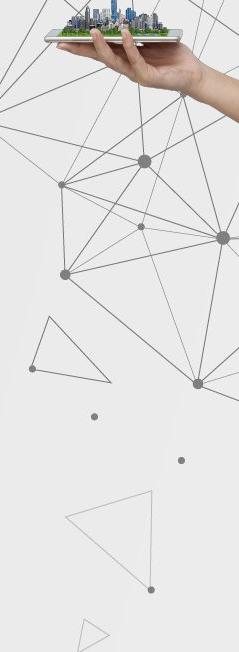
Noise Monitor



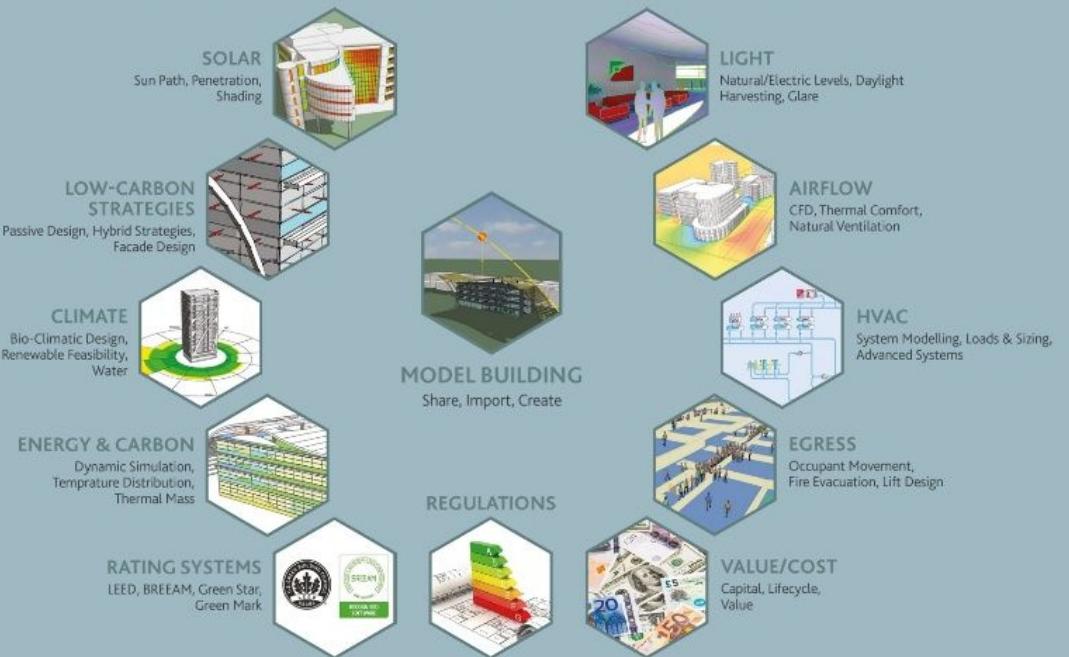
NYC
Smart Bikes



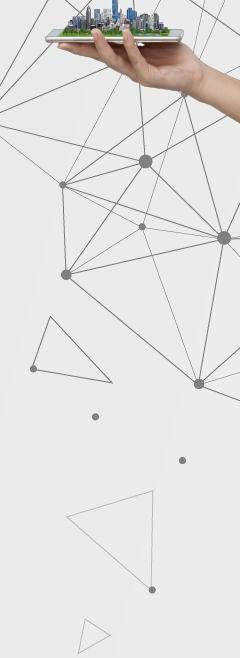
Flood Sensors
Oxford



VIRTUAL ENVIRONMENT

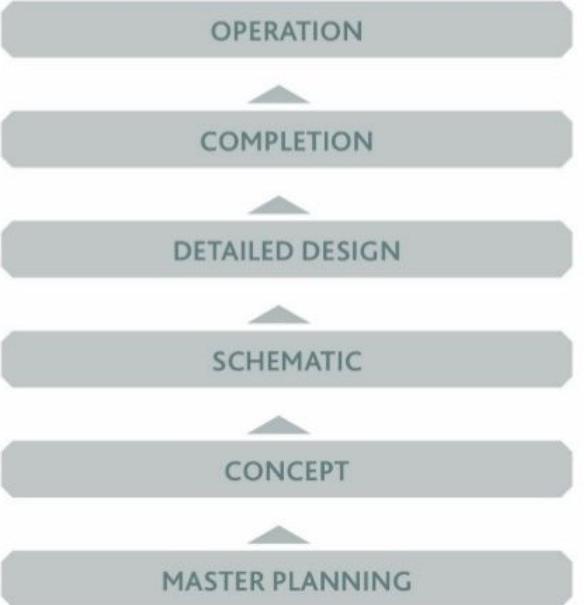


Who is the typical building simulation client?



EARLY STAGE – DETAILED DESIGN

Use VE for Engineers across the entire design lifecycle



ARCHITECTURAL

- Designers
- Architects
- Master planners
- Urban designers
- Interior Designers

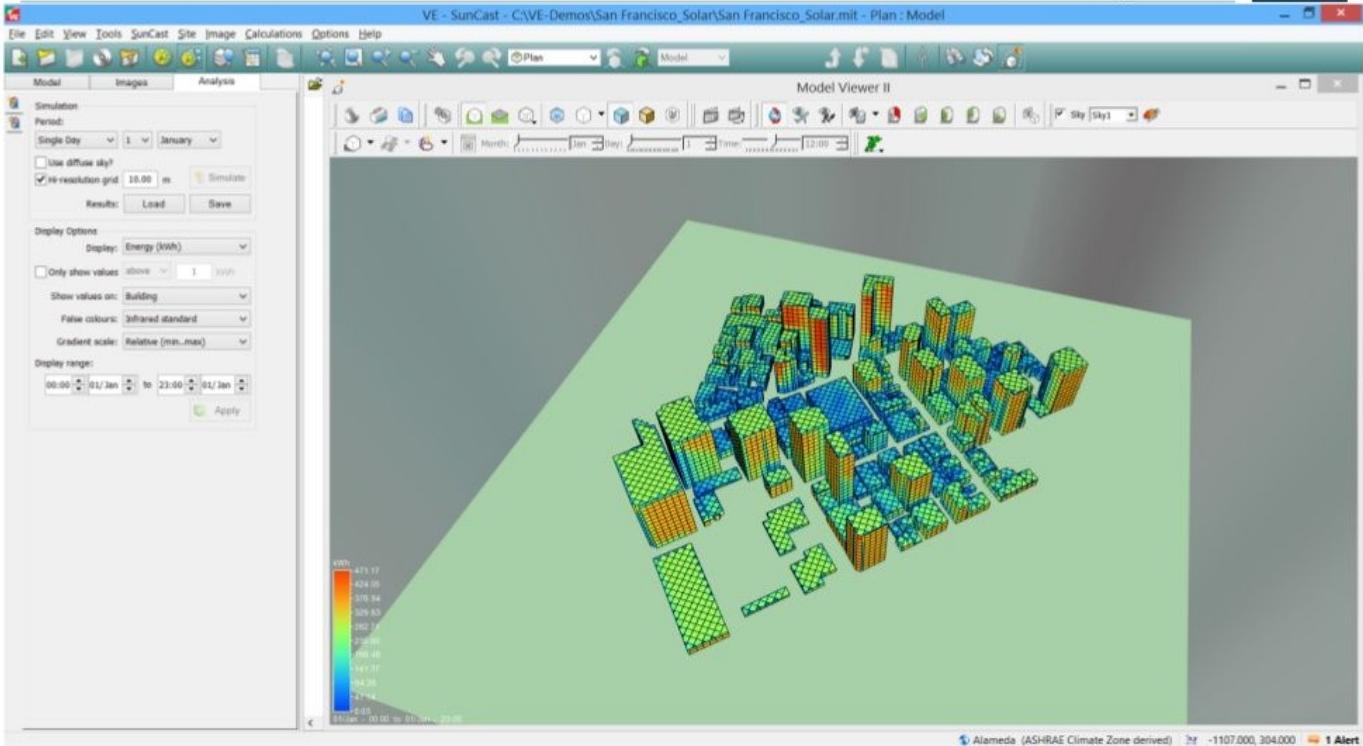
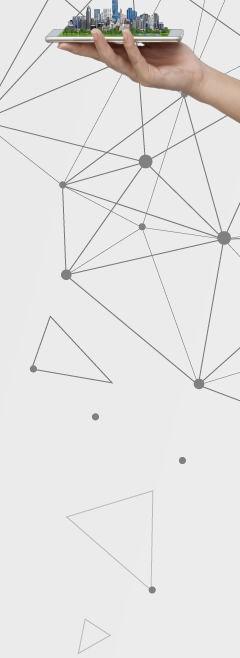
ENGINEERS

- HVAC
- Mechanical
- Electrical
- Building Physics
- Other “green” rating systems

GREEN CONSULTANTS

- BREEAM
- LEED
- DGNB
- Estidama
- Other “green” rating systems

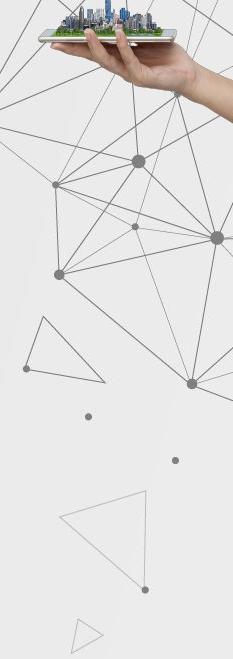
Surface Solar Radiation: Winter Day



Surface Solar Radiation: 15 January (Red High, Blue Low)

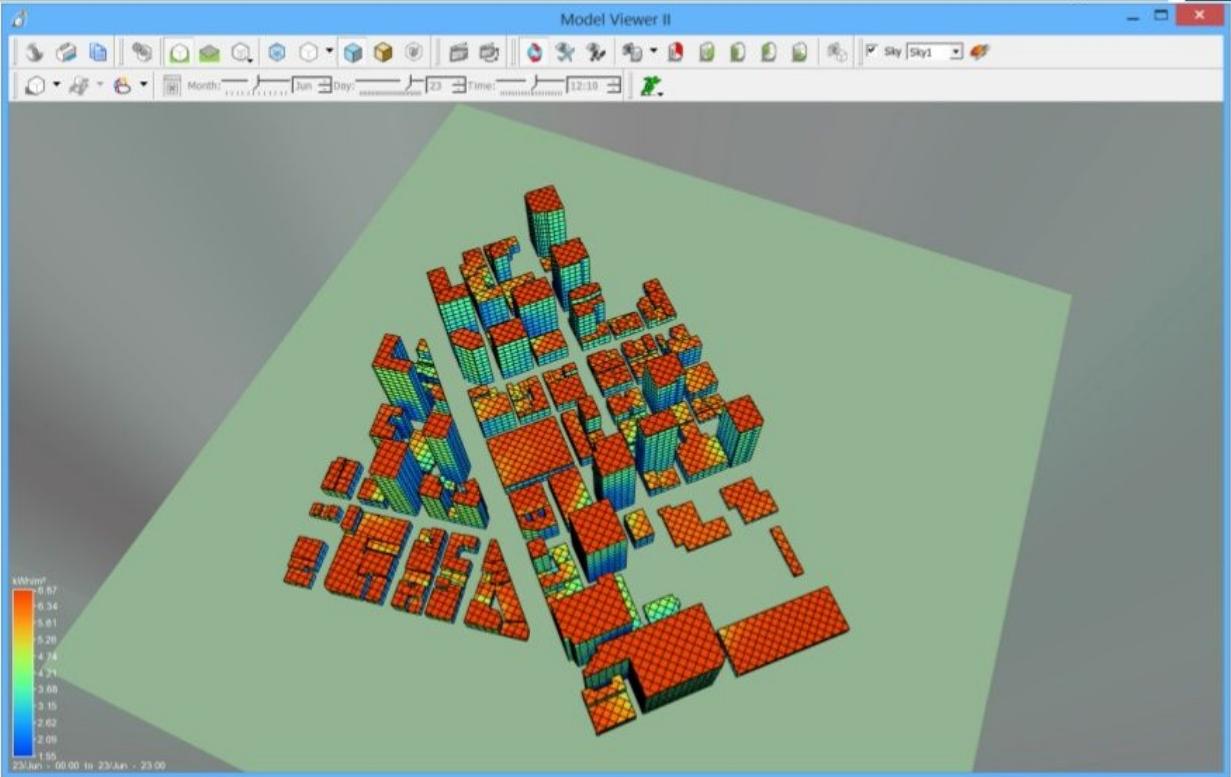
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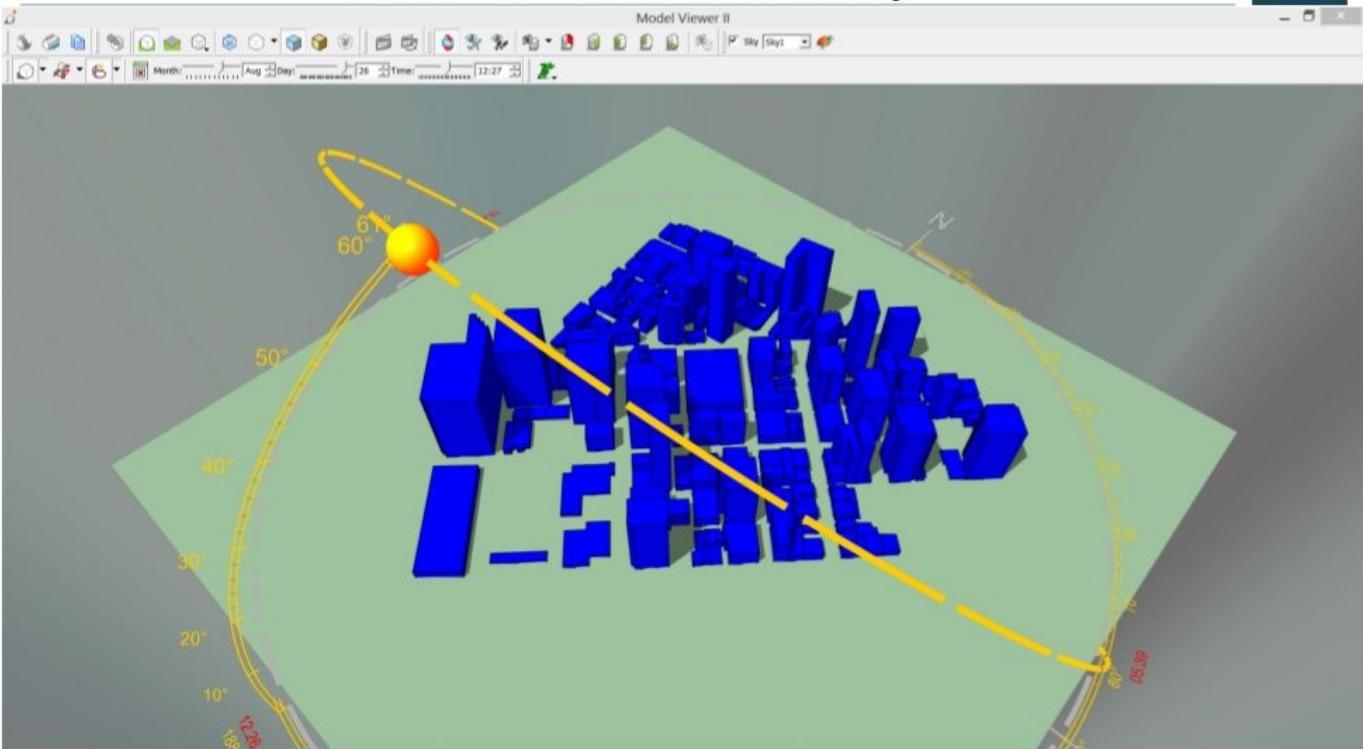
Surface Solar Radiation: Summer Day

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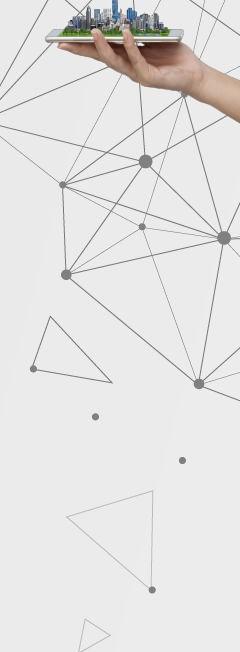
Surface Solar Radiation: 23 June (Red High, Blue Low)

Solar Shadow Study

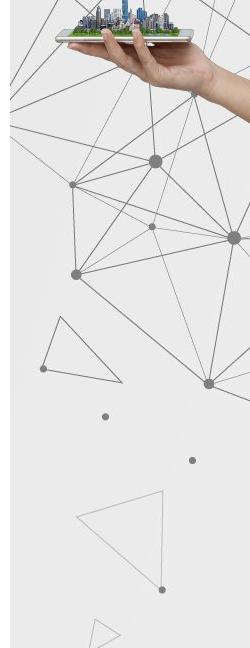


Shadow studies

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Energy Analysis

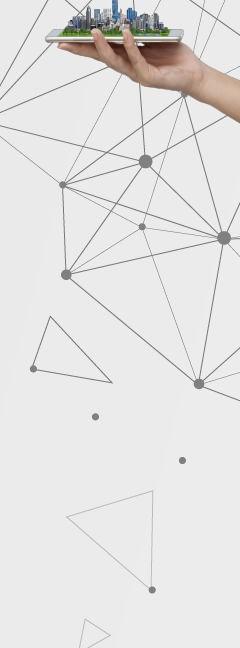


District buildings modelled in more detail

Energy Analysis

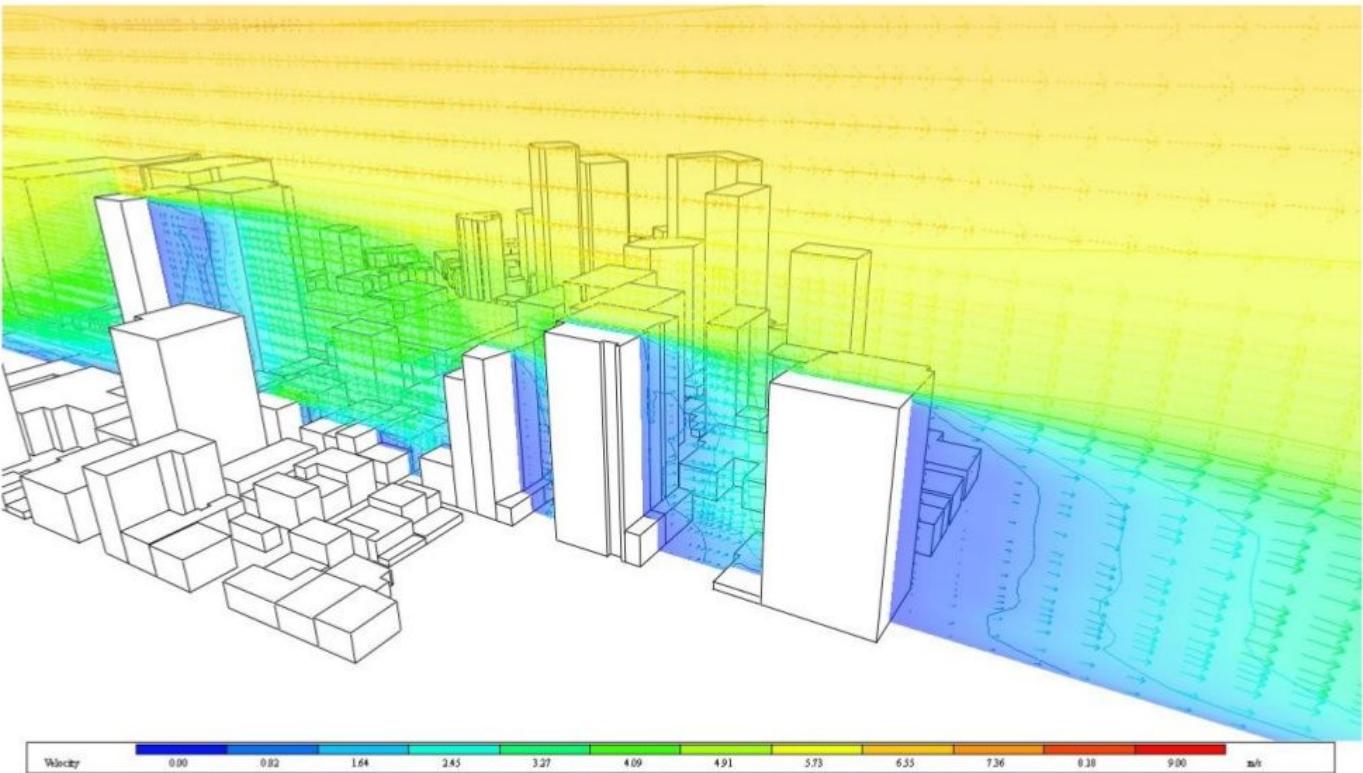


Define buildings by spaces types for general analysis





VE-Pro: External Air Flow



Digital Cities

Combine mapping, building, civil engineering, utility and other 3D data into accurate models that can be visualized, analyzed and shared





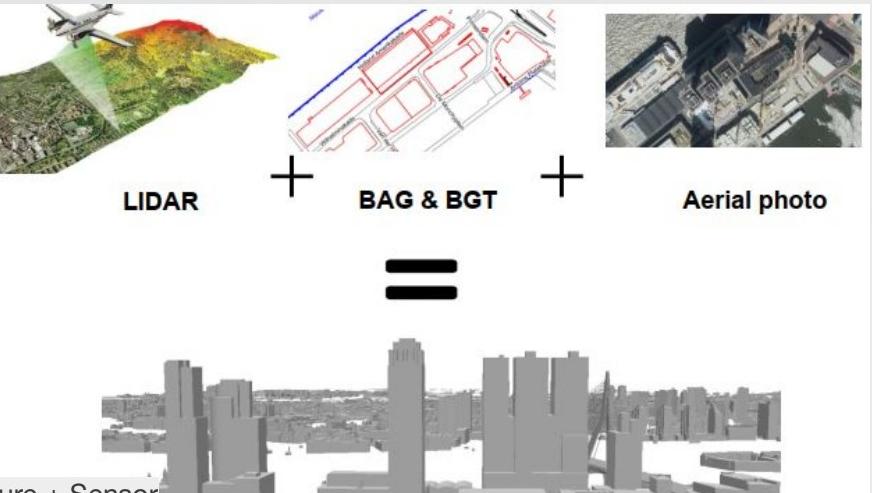
(1) 3D Data Capture /
Data Collection



(2) 3D Data Standards
and Modelling



(3) 3D Data Sharing



Data Explosion Location + Feature + Sensor
Point Cloud + Realistic Mesh + Semantic
Model + Volumetric Data + Live Data +
Visualization + Simulation + IoT + Analytics +
...



Project Areas



Mesh Models



3D Textured Mesh Model



Process for Building Infraworks Model

PHASE I

IMPORT EXISTING GIS DATA FOR PROJECT AREA

Topography, Roads, Parking Lots, Streams, Buildings, Etc



PHASE II

IMPORT REALITY CAPTURE POINT CLOUDS

UAV Data
Laser Scan Data



PHASE III

ADJUST ELEMENTS TO MATCH & ADD DETAIL

Road & trail alignment, building façade detail, etc.



PHASE IV

ADD TRAIL FEATURES TO MODEL

Bike path, light poles, cars, people, vegetation, Etc



These new smart cities are likely to **be powered**, by **seven technologies**
that **The World Bank believes** will disrupt and transform **how cities deliver services to their citizens**



5G mobile networks,

Blockchain

Artificial intelligence

Autonomous vehicles

Low-cost space exploration
and micro-satellites

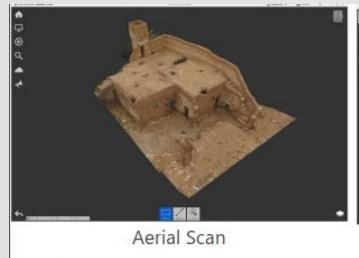
Biometrics

Drones

3D Survey Integrated Mapping using LiDAR-Static/Mobile/Aerial Scanning with Supplemental RTK GPS/Digital Leveling/TS/UAV Existing Conditions



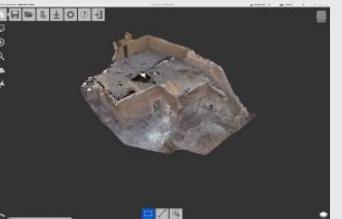
Create 3D Digital Cities Using Drones



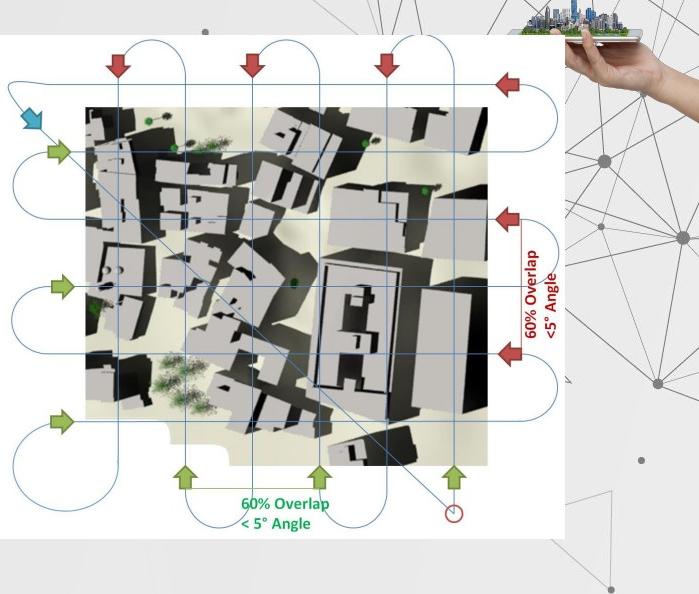
Aerial Scan



Terrestrial Laser Scan



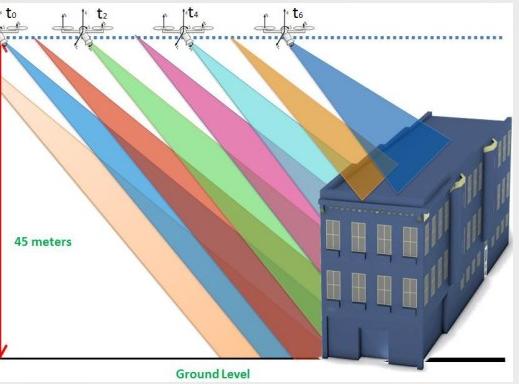
SfM Scan



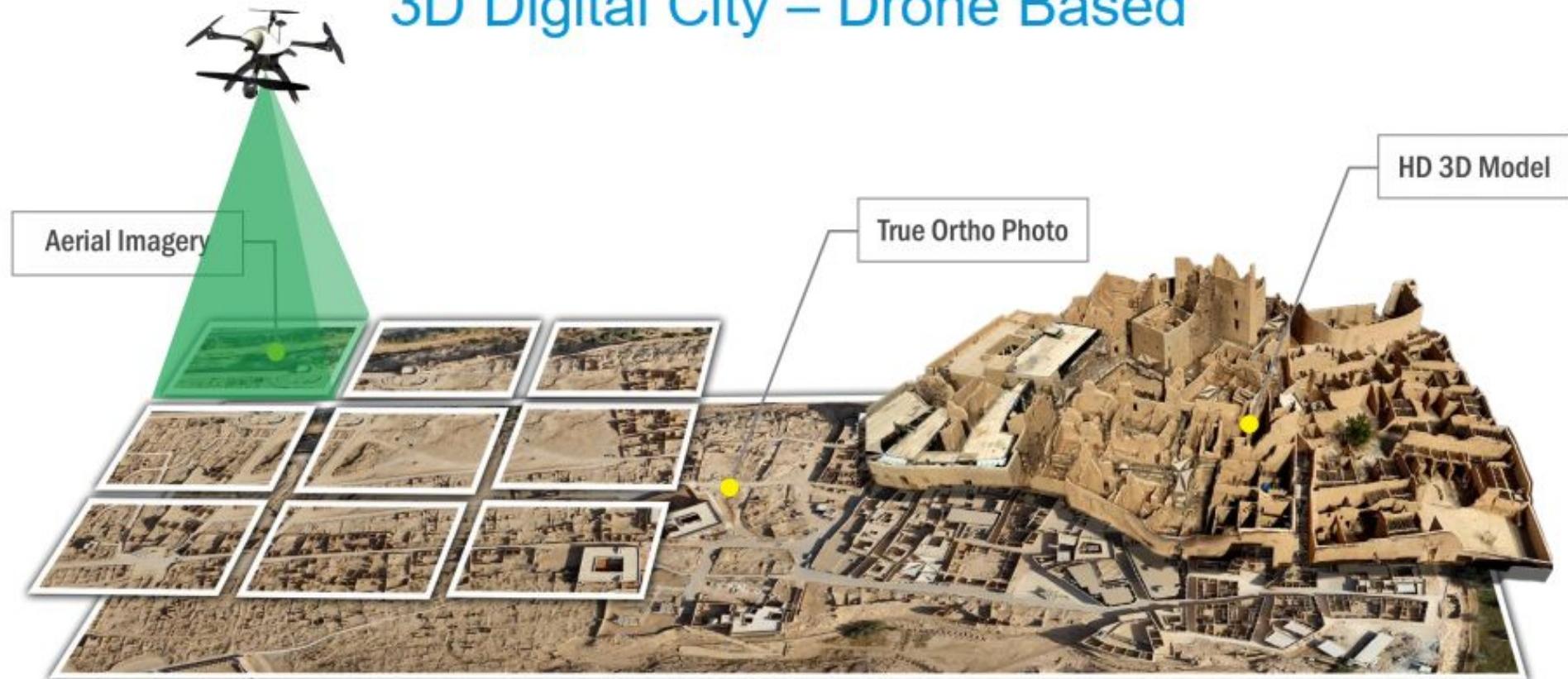
Satellite image +/- 30 cm



FalconViz drone image +/- 2 cm

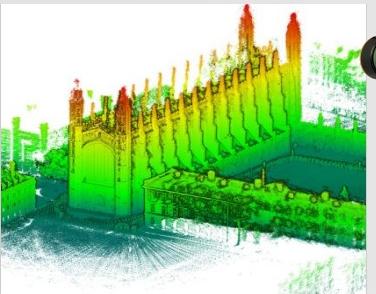


3D Digital City – Drone Based



drone and vehicle based scanning and camera device

zeb horizon (detail context capture scan)



CONTEXT CAPTURE

Reality modeling is the process of capturing the physical reality of an infrastructure asset, creating a representation of it, and maintaining it through continuous surveys. Bentley's reality modeling software, ContextCapture, provides you with real-world digital context in the form of a 3D reality mesh.

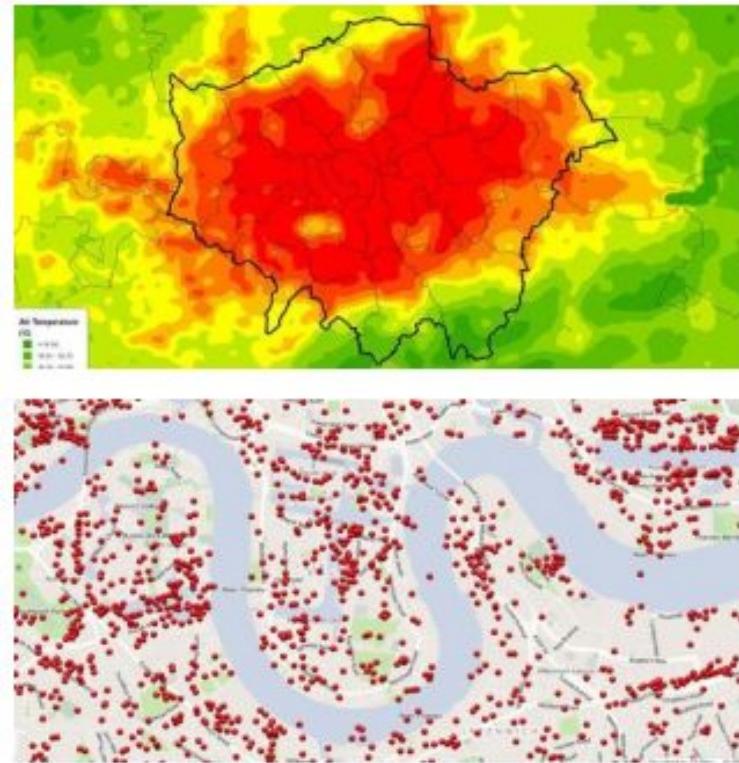
COLLAGE

Post-processing software for Topcon's mass data solutions

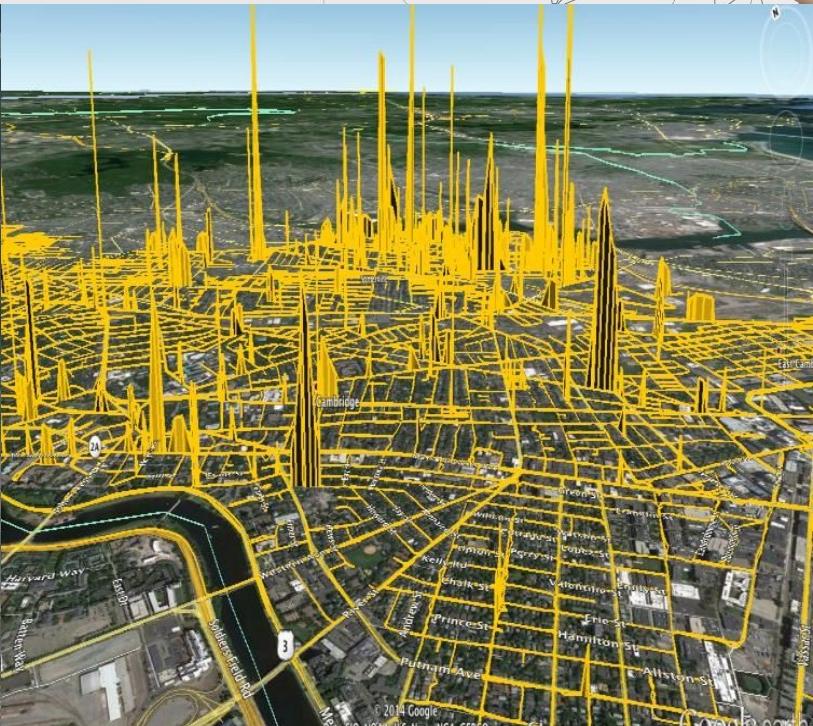
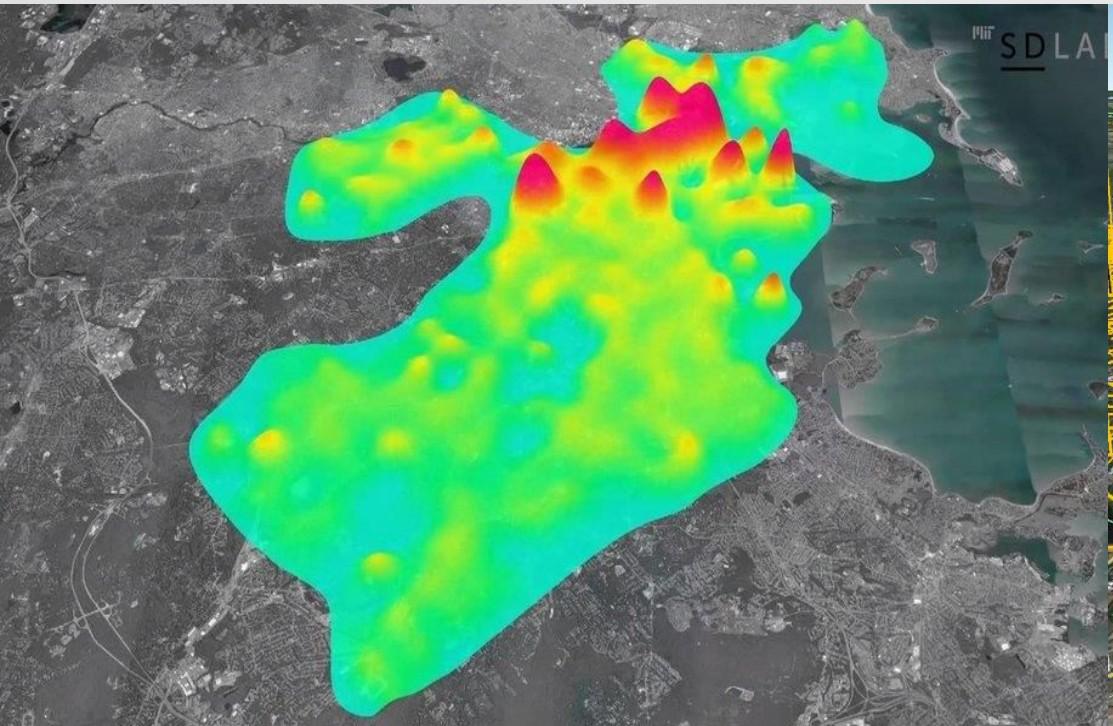
Processes the raw data for the following systems:

IP-S3 Mobile Mapping System:

Monitoring performance across the city – via the model and linked dashboards



Boston smart city heat and gas leaks map



<https://www.edf.org/climate/methanemaps/city-snapshots/boston>

<https://www.google.com/maps/d/u/0/viewer?mid=1u2rultCwcVDMepvD0PDrRfv6n-jQcL4&ll=42.5168195912234%2C-73.20718368088725&z=12>



LEEDS CITY DASHBOARD



Weather

5-day weather forecast for Leeds

Day Night Tue 6 Jun

High: 13° Low: 10°
Heavy rain

Chance of rain: 85% | UV Index: 2 | Humidity: 88%

Wind Direction: W | Wind Speed: 20 mph

Author: Ste Allan

TUESDAY

6 TH
JUNE 2017

Pedestrian Accident Locations

Concentrated locations of accidents involving pedestrians

Author: Liam Bolton

Leeds Footfall Trends

Weekly footfall stats for Leeds City Centre

Figures for the week commencing Mon, 3rd October 2016 and ending Sun, 9th October 2016.

Previous week -6% ↘
Same week in 2014 11% ↑
Same week in 2013 11% ↑
2015 Weekly Average 13% ↑

Author: Simon Zimmerman

Leeds Car Parks

Registered spaces available in Leeds

Albion Street

P Albion Street

FOI & EIR

Number of FOI & EIR Requests

Dec-14

FOI & EIR Requests received 95

Within 20 days 89.6% | Over 20 days 10.4%

Response time

Full Disclosure 19 | Partial Disclosure 81 | Withheld 11

Author: Nathan Smith

Leeds Inspired

Music & art events around Leeds

Multi-Sensory Social Extra

5 Jun 2017 10:30am - 12pm
Room 700, Leeds Central Library

A multi-sensory social gathering where new parents can get together in a relaxed yet stimulating environment with their babies. Enjoy light show projections, sound effects, objects to feel and evocative smells to explore. The session will conclude with gentle stories and rhymes. Suitable for pre-crawlers, not suitable for

16 Licensing | 566 Planning

View Stat Notices

Author: Nathan Smith

Smart City

Community



Social



Economic

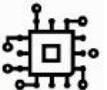


Ecological

Location
based
approach



Digital Twin



Geospatial Data | Spatial Data | Sensor Data | Data

Connecting infrastructure: all roads lead to the Digital Twin

Developing a **digital twin**: a virtual model of the infrastructure which will both

monitor infrastructure in real-time
and have **predictive capability**.

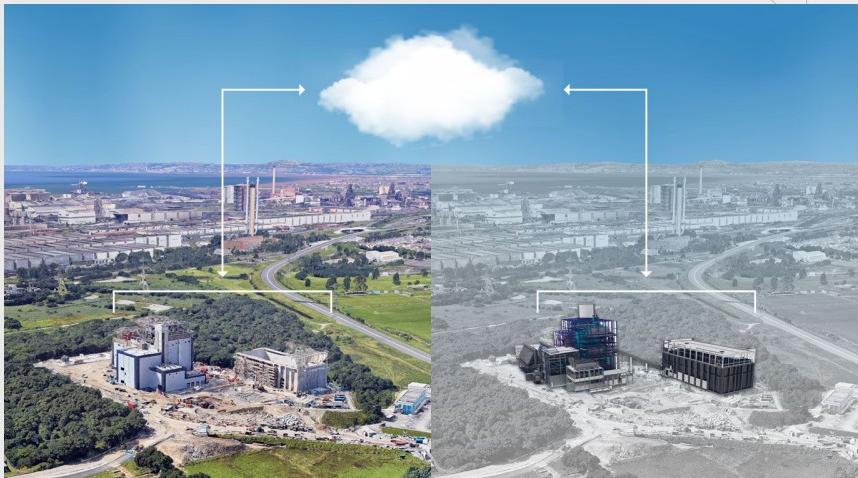
This will help **manage, plan, predict and understand** the infrastructure, delivering resilient, responsive, high-performance systems.



Three demands for useful and modern digital city twin

- It's available through **open** interfaces
- It's up-to-date **all the time**
- Extensive data content (not only buildings)

3d Digital Model with Intelligent Data
Is essential For Smart Cities



“the Digital Twin”

A digital version of the real world including **physical assets indoors, outdoors, above and below ground.**

An integrated approach -multiple contributors, multiple geometries

enables **scenario modelling, simulation and analytics**

Dynamic and linkable representations of real-world features, supported with strong, **persistent identifiers.**

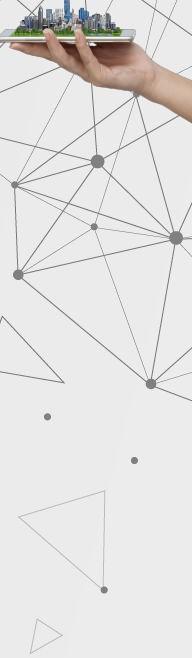
Machine **readable content**, integrated with other views of the real world

“The best way to predict the future is to create it.”

Abraham Lincoln



virtual model of London



Operations

Technology



Executive Management

Operations



City Planning



Marketing & Sales



Partnerships



Predict

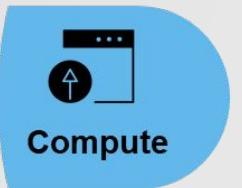
Visualize



AR/VR



Artificial Intelligence
Big Data Analytics



City Digital Twin

Orbit 3DM Content Manager

AN INDISPENSABLE STEP IN THE 3D MAPPING DATA CHAIN

Organize & manage

Catalog & Archive

Improve & optimize image and point cloud data

QA/QC

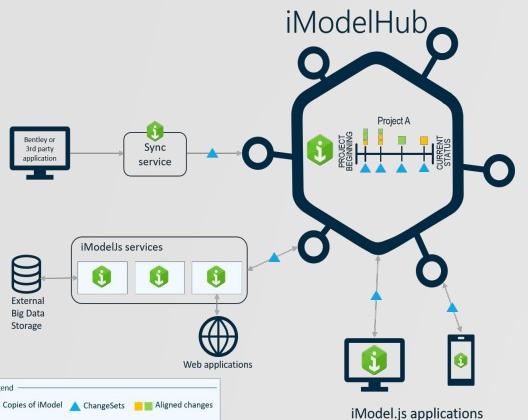
Document and report independent

Deliver ready-made projects after capture

Upload to share online

[FEATURES](#) [DOCS & DOWNLOADS](#)





<https://www.itwinjs.org/>

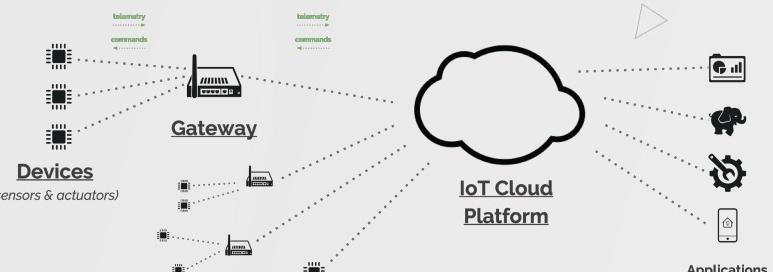
open platform for digital
twins



asset management solutions

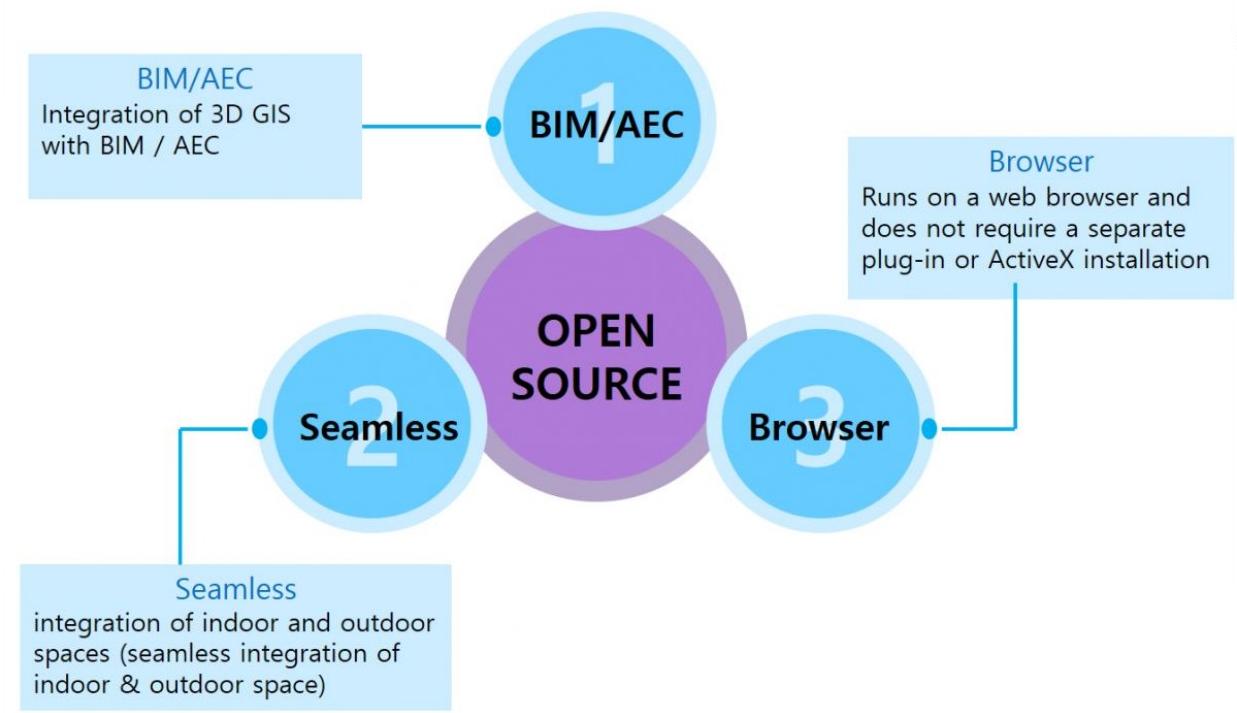


AssetWise - Asset Information
Management Software



iot sensor platform and devices

mago3d

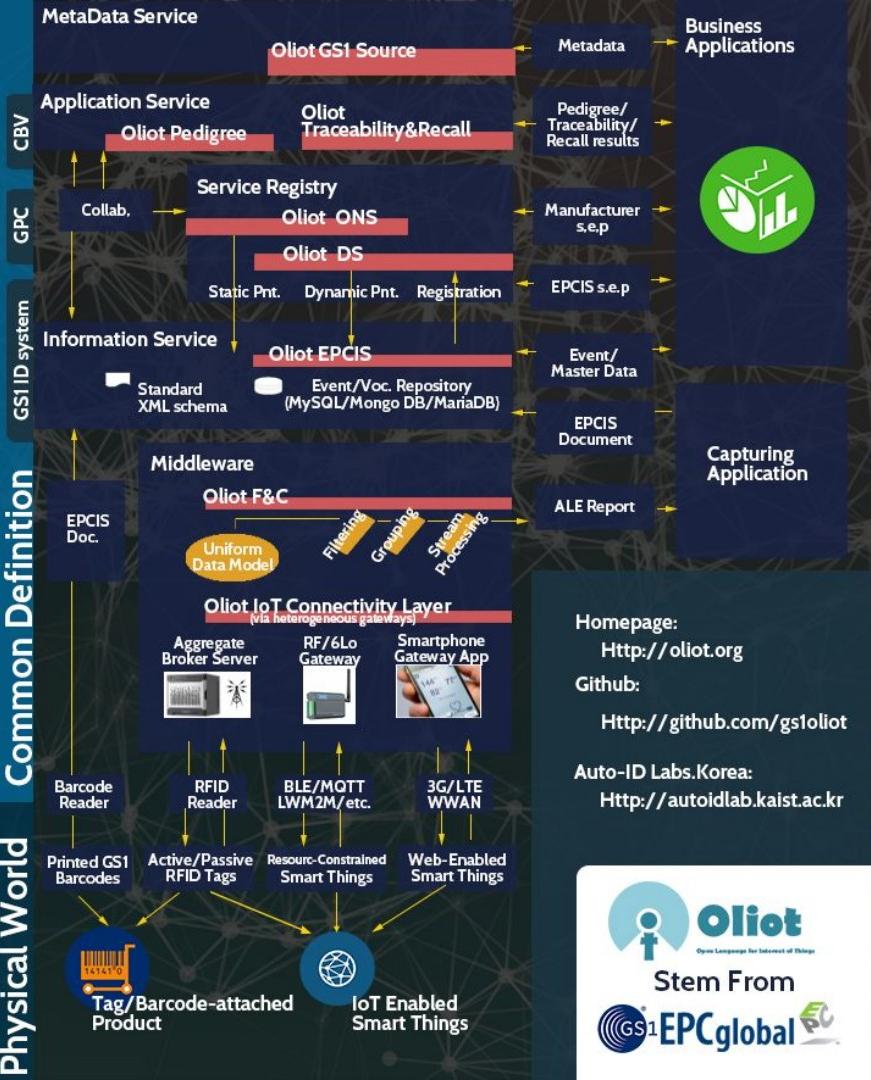


[http://www.mago3d.net/homepage/
demo.do?viewLibrary=worldwind&
lang=en](http://www.mago3d.net/homepage/demo.do?viewLibrary=worldwind&lang=en)

Internet Of Things



Oliot is aiming an international standard based **Internet of Things (IoT) Infrastructure Platform**, by extending the code system of GS1 and their standard architecture to support various IoT connectivity and protocols such as bar code, 2D DataMatrix, QR Code, RFID, ZigBee, 6Lo, Bluetooth Low Energy, OneM2M, OCF, etc. Oliot also aims a complete implementation of GS1/EPCglobal standard.

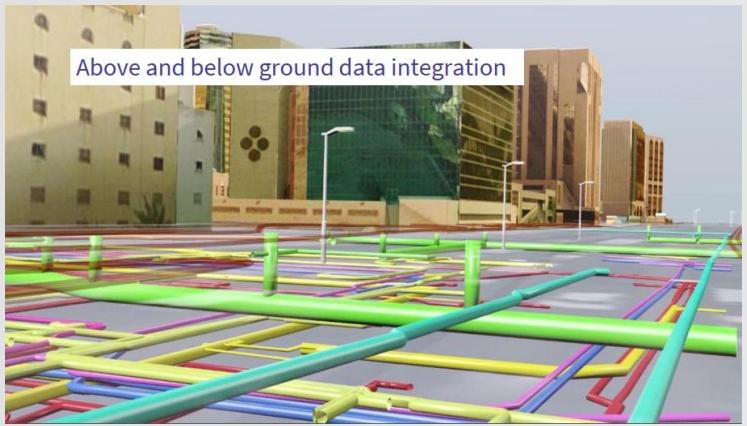


IOT

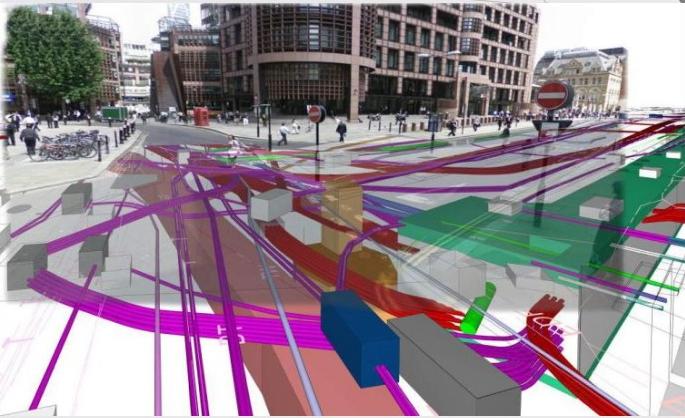


Stem From
GS1 EPCglobal

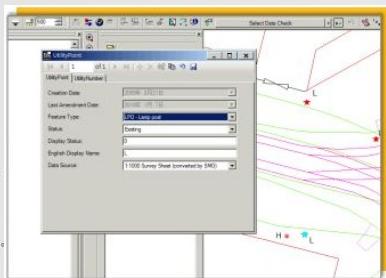




Above and below ground data integration



Use Artificial Intelligence (A.I.) for mapping



Conventional Feature Extraction
by Coding

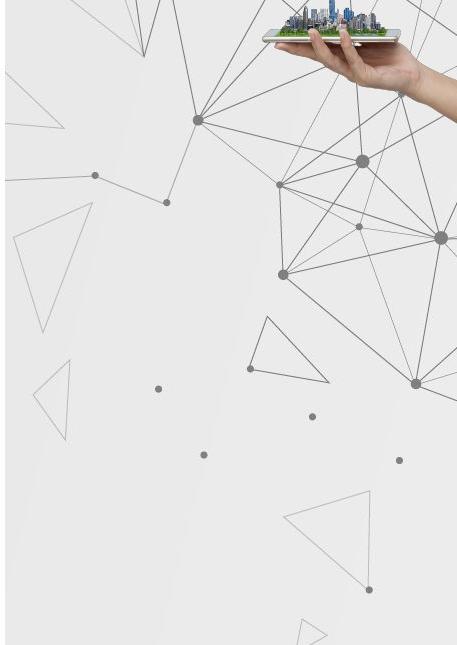
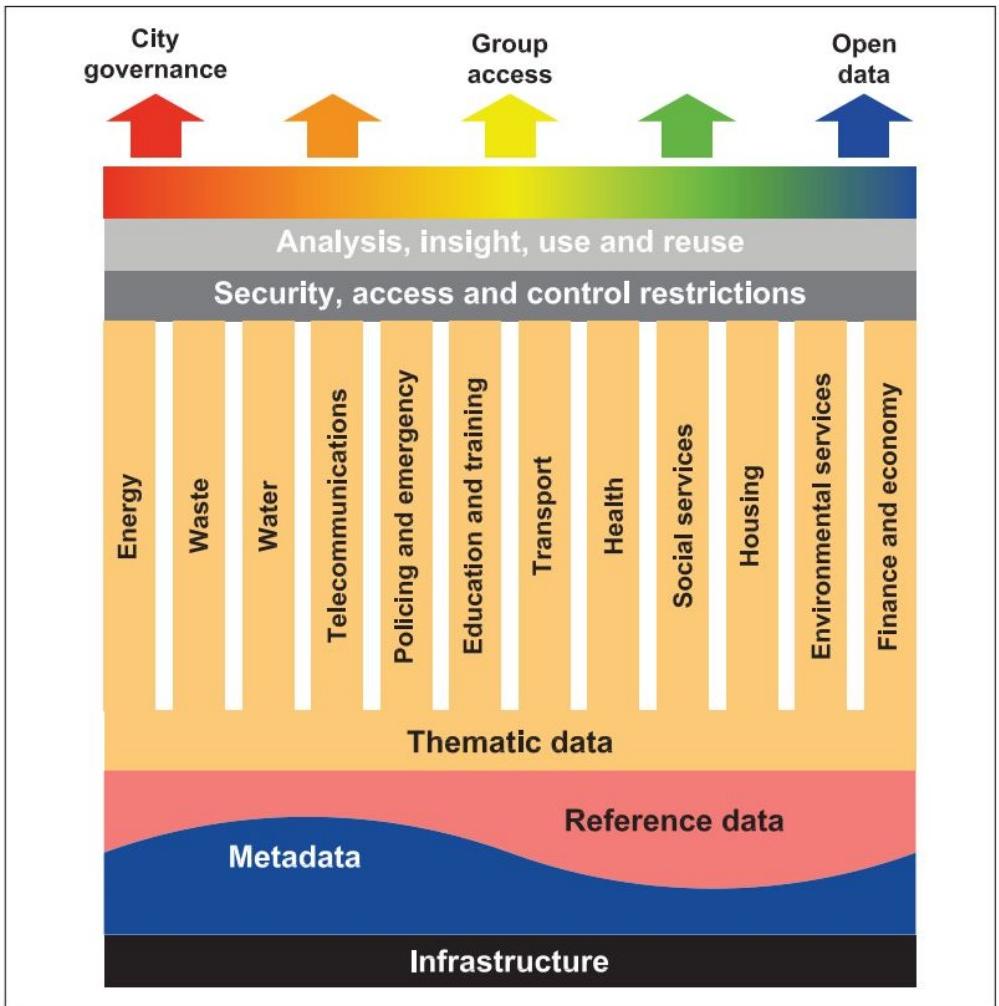


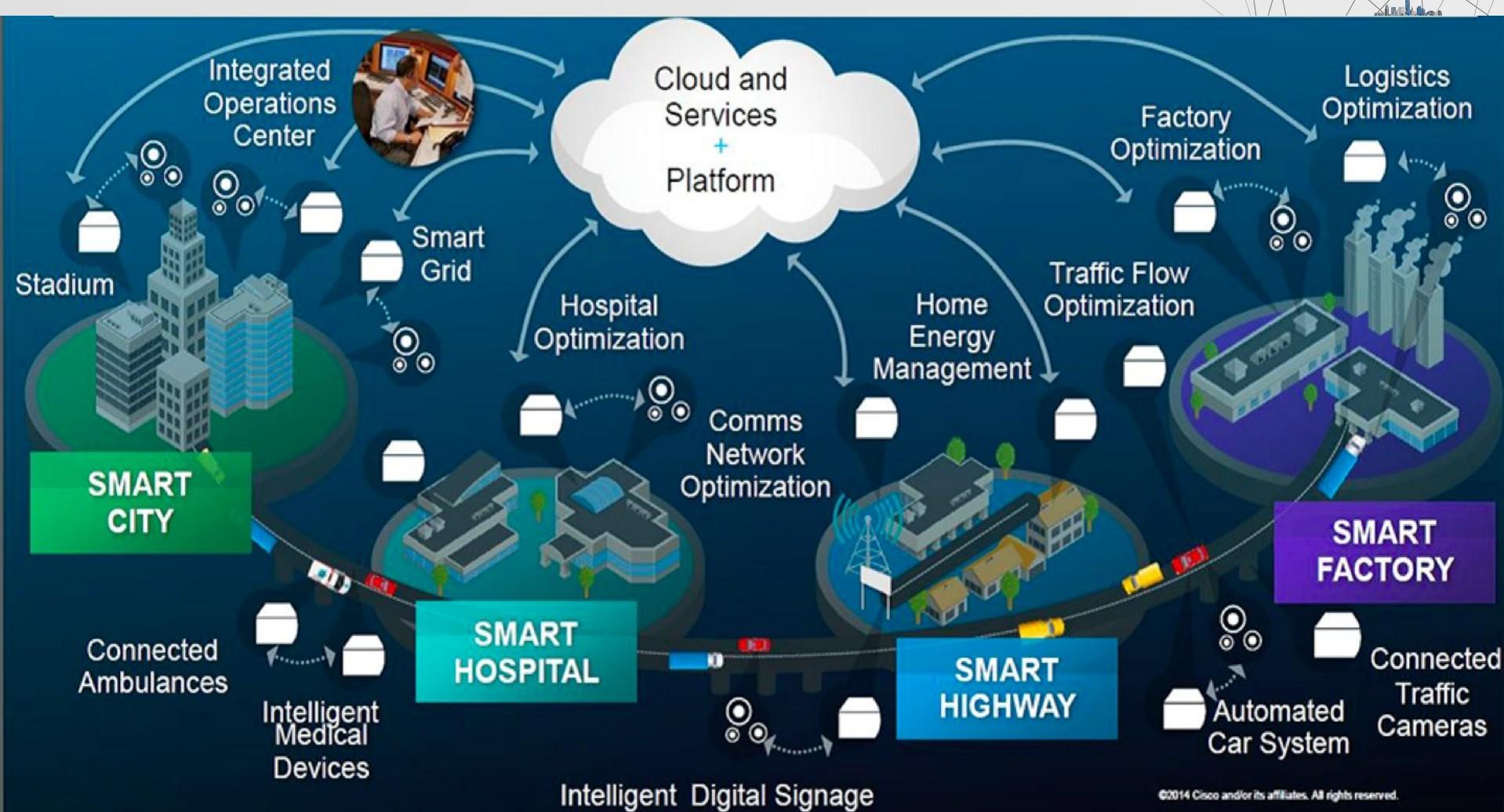
Automatic Feature Extraction by A.I.

There're basically and originally differences between BIM data and GIS data.

BIM data	GIS data
objects of Buildings	Objects on the Earth
Walls, Pillars, Floors, Windows, Doors, etc.	Roads, Buildings, Mountains, Trees, etc.
Usually created by Human	Usually generated via surveying(and processing)
.RVT, .IFC, and so on .	SHAPE, .GEOTIFF, and so on

Data framework







City government
More efficient city
management



City residents
Services and
information



Integrated city management platform

Supervision and coordination

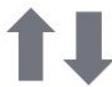
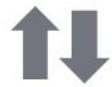
Information
sharing

Incident
management

Management and optimization

Business
intelligence

Decision
support



Traffic
management

Public
transport

Electric
vehicles

Events and
emergencies
management

Weather and
emissions

Security

Integrated city management platform

Building Information Model : A Building Information Model or BIM utilizes cutting edge **open standard digital technology**



to establish a **computer generated representation** of all the physical and functional characteristics of a facility and

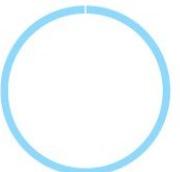
to establish its related **project/life-cycle information**, and

is intended to be a **repository of shared information** for the facility owner/operator to use and maintain throughout the life-cycle of a facility.





How are we using 3D Models?



VISUALISATION



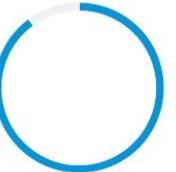
- Design / Drawing Production
- 3D Details
- CGI
- Virtual reality



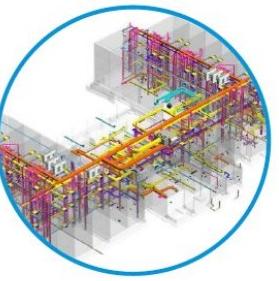
CLASH DETECTION



- Clash avoidance
- Cost Avoidance



MODEL COORDINATION



- Digital Twin
- Fully coordinated 3D Project



4D MODELLING



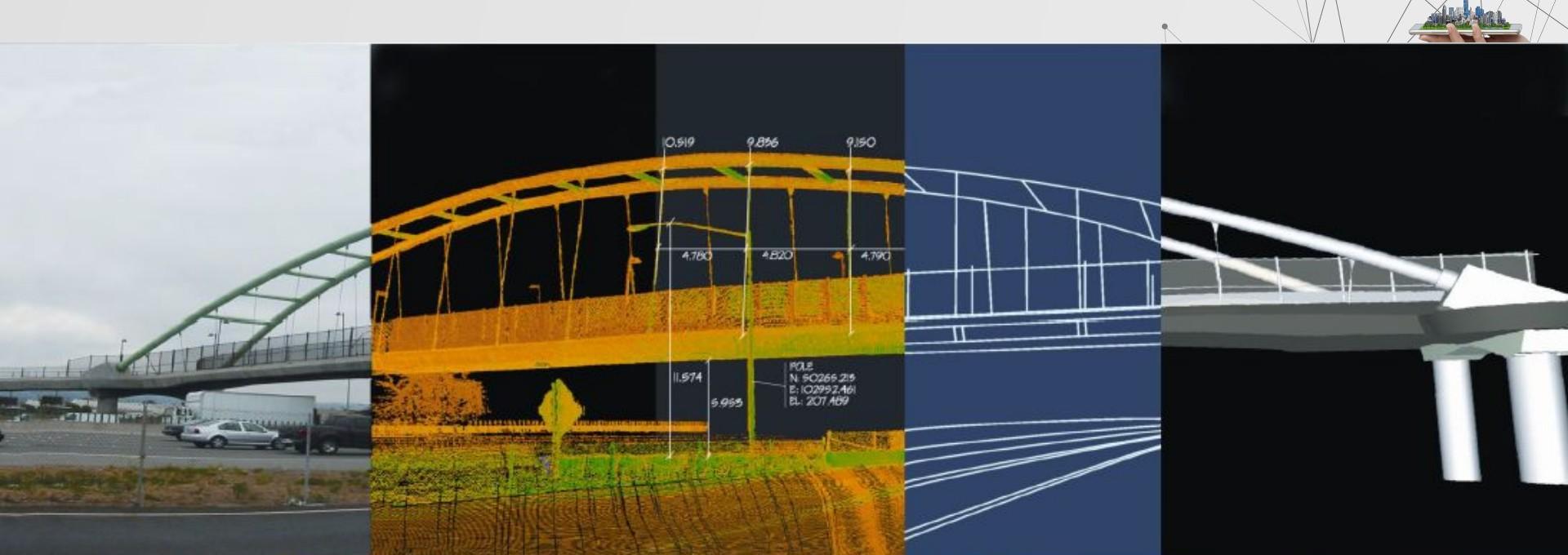
- Construction Simulation
- Logistic



5D MODELLING



- Quantity take-off
- Costs



**Georeferenced
Hi-res Digital
Images**

3D

XYZ Return

LAS Point Clouds

2D -3D Feature Lines

3D DTMs-TINs

X-Sections

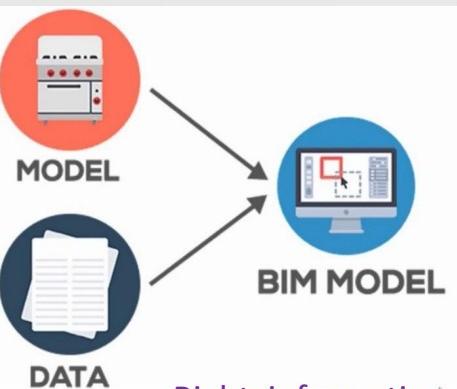
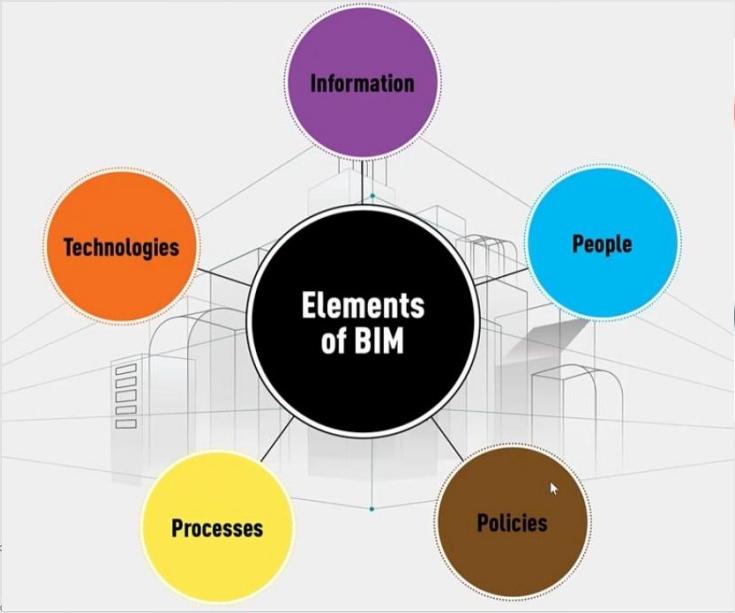
3D

CIM-BIM

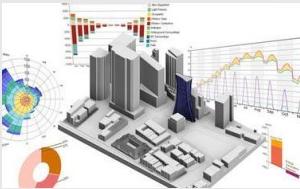
DSMs

BIM

- BIM stands for Building Information M.....
- Model (smart composition of objects + information)



Right information,
in the right form,
from the right person,
at the right time



- Modeling

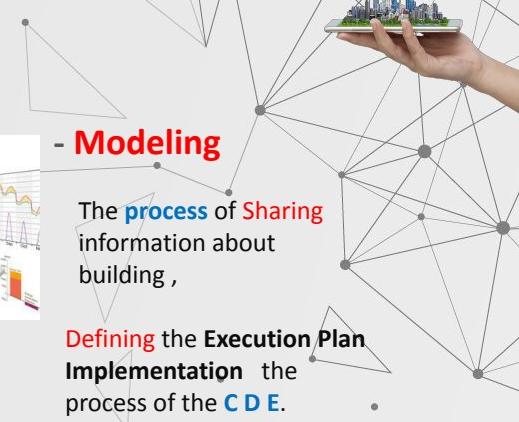
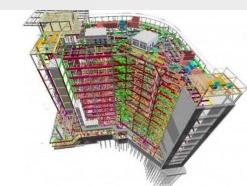
The **process** of **Sharing** information about building ,

Defining the **Execution Plan**
Implementation the process of the **C D E**.

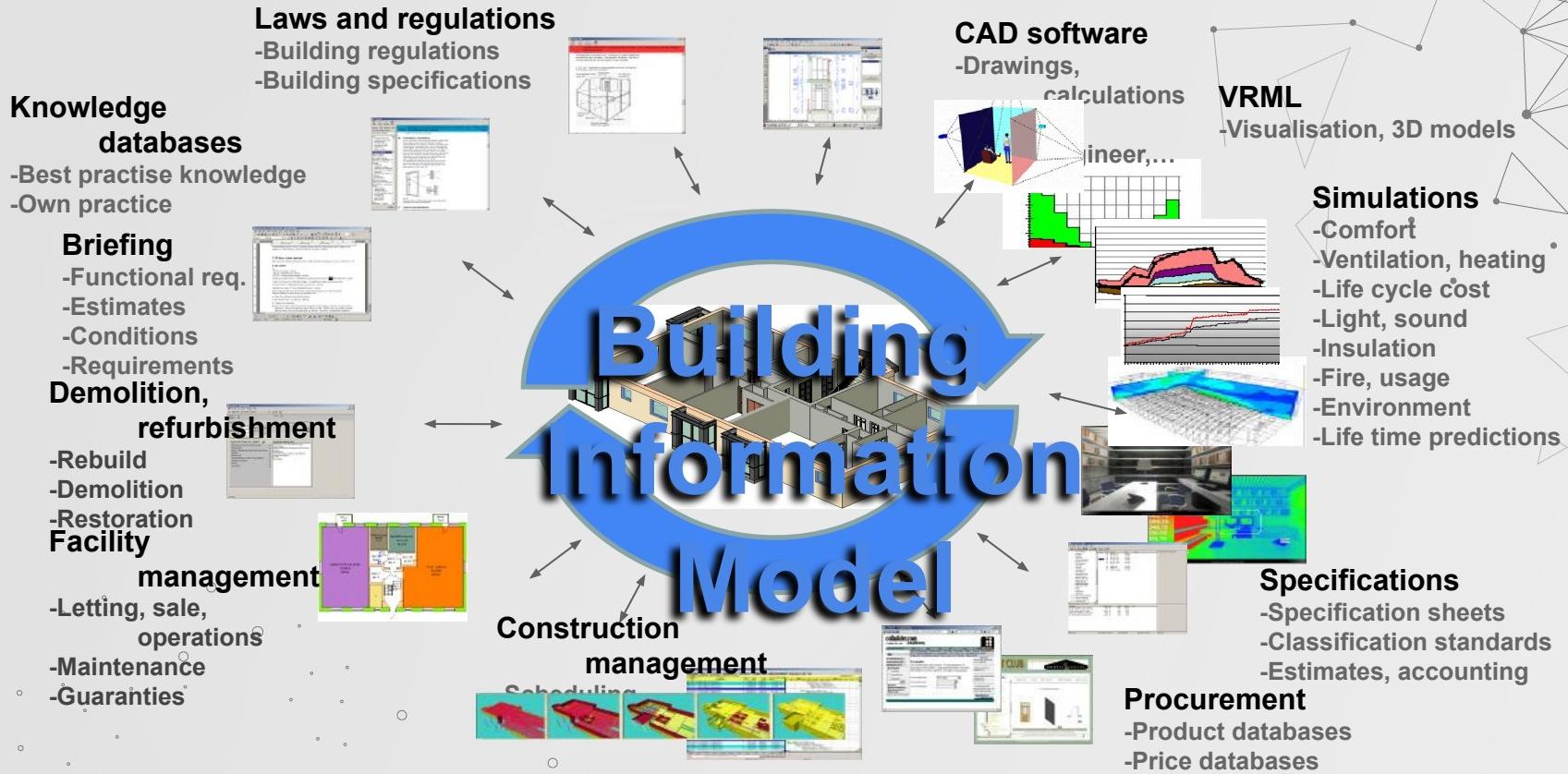
-begins with **creating** an intelligent 3D design model

-uses that model to facilitate coordination, simulation, and visualization,

- **helping** owners and service providers **improve** how **buildings** and **infrastructure** are planned, designed, built, and managed.

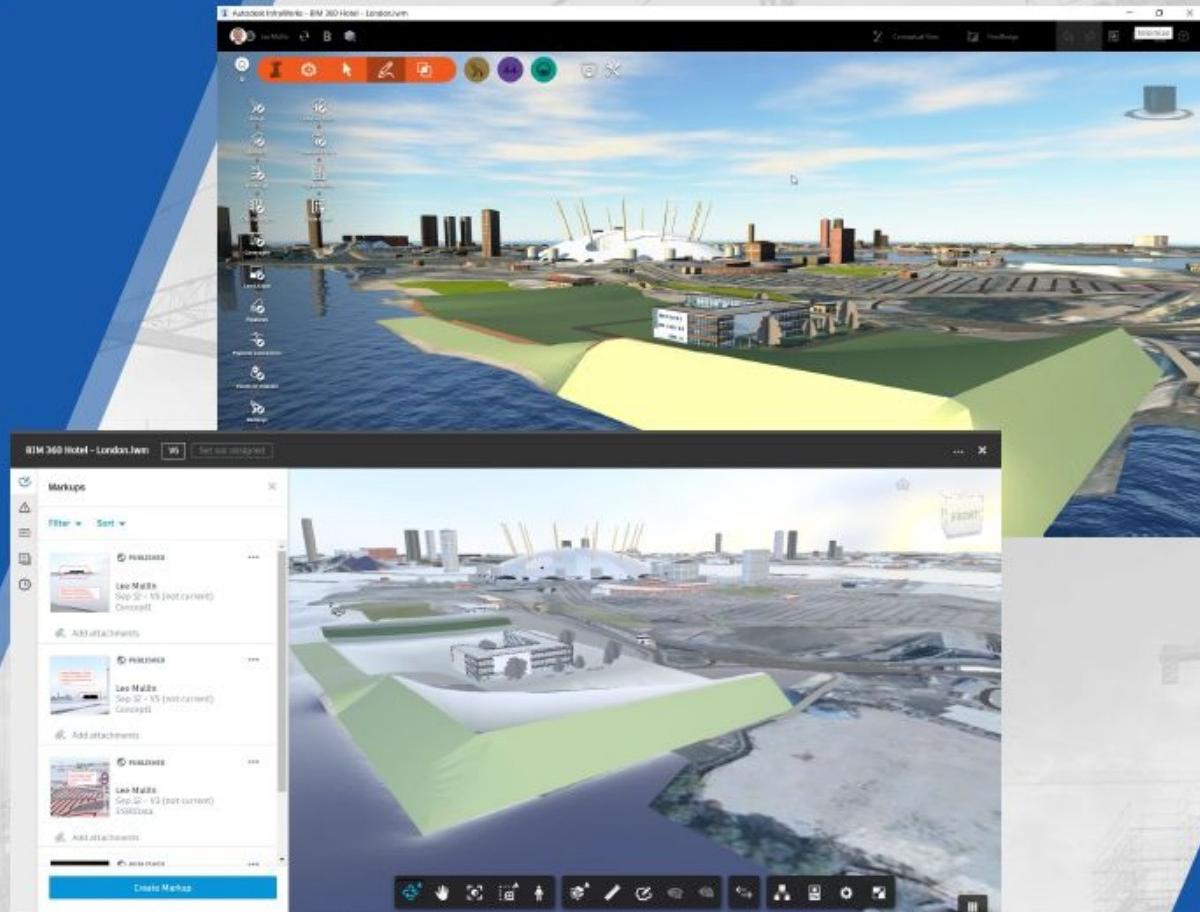


Lifecycle Information View

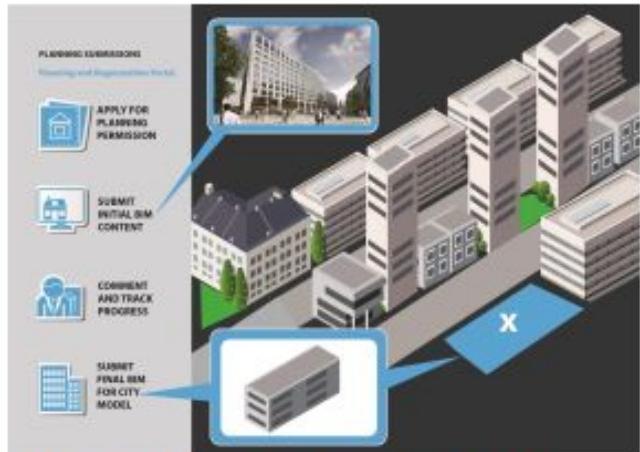


VIEW MODEL IN CONTEXT

- Load Revit model published into BIM 360 into Infraworks for context
- View different landscaping and traffic scenarios
- Create Markup and Issues on the design in context



Better more informed planning decisions using the model



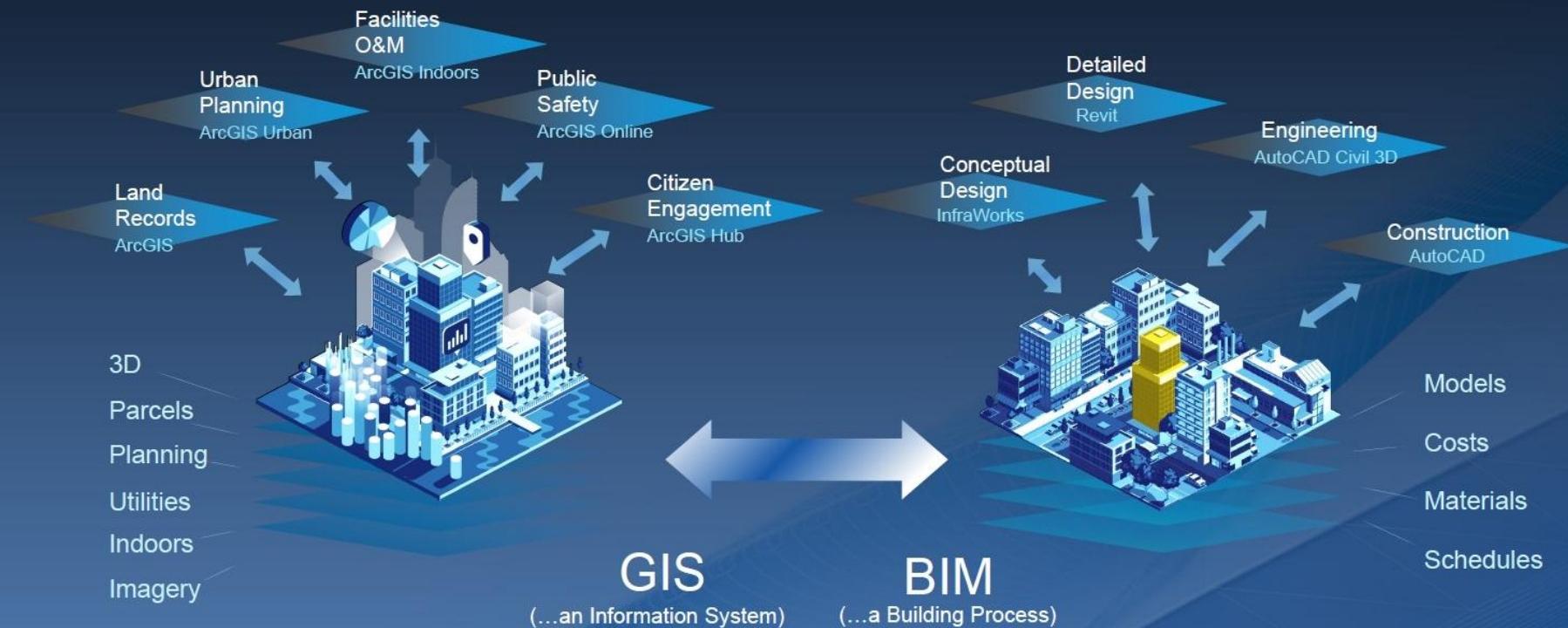
At planning the concept model is placed in the model



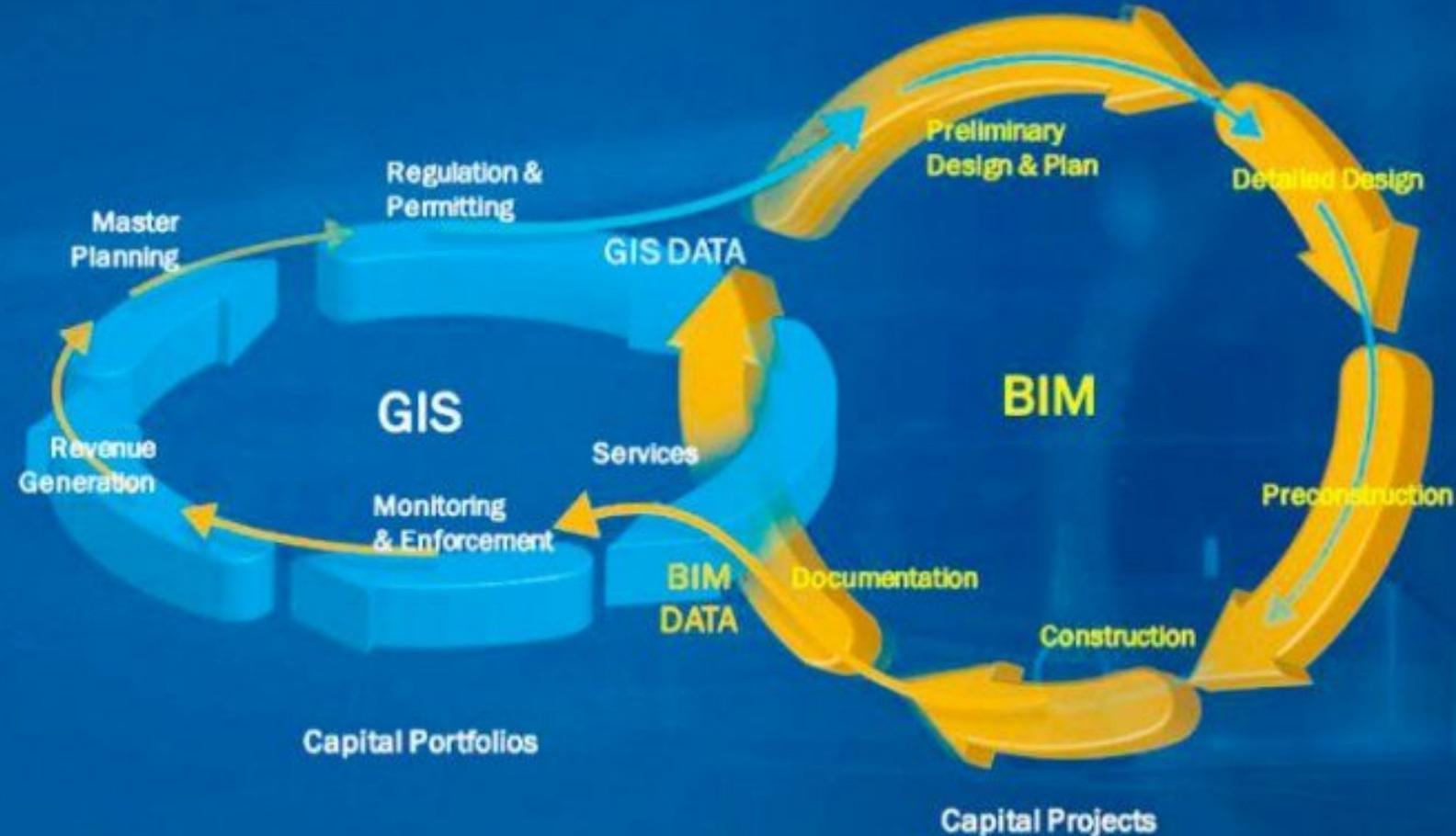
The model helps planners to understand the impact a development will have

Smart Cities and Infrastructure with GIS and BIM

Technology integration leads to smarter more efficient cities

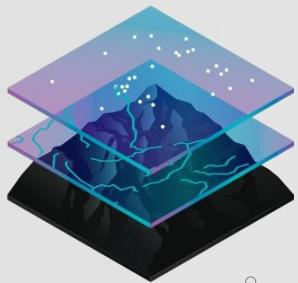


BIM and GIS Workflows Are Happening Continuously in Smart Cities

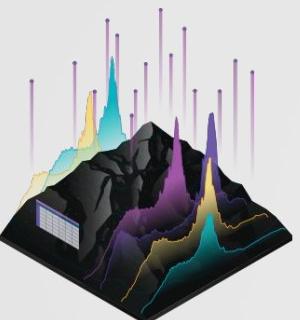


Geographic Information System (GIS)

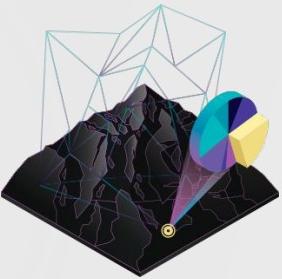
is a framework for gathering, managing, and analyzing data. Rooted in the science of geography, GIS integrates many types of data. It analyzes spatial location and organizes layers of information into visualizations using maps and 3D scenes. With this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations—helping users make smarter decisions.



Maps



Data



Analysis



Apps



What is CIM?

“Civil Integrated Management (CIM) is the technology-enabled collection, organization, managed accessibility, and the use of accurate data and information throughout the life cycle of a transportation asset. The concept may be used by all affected parties for a wide range of purposes, including planning, environmental assessment, surveying, construction, maintenance, asset management, and risk assessment.” -FHWA, AASHTO, ARTBA (2012)

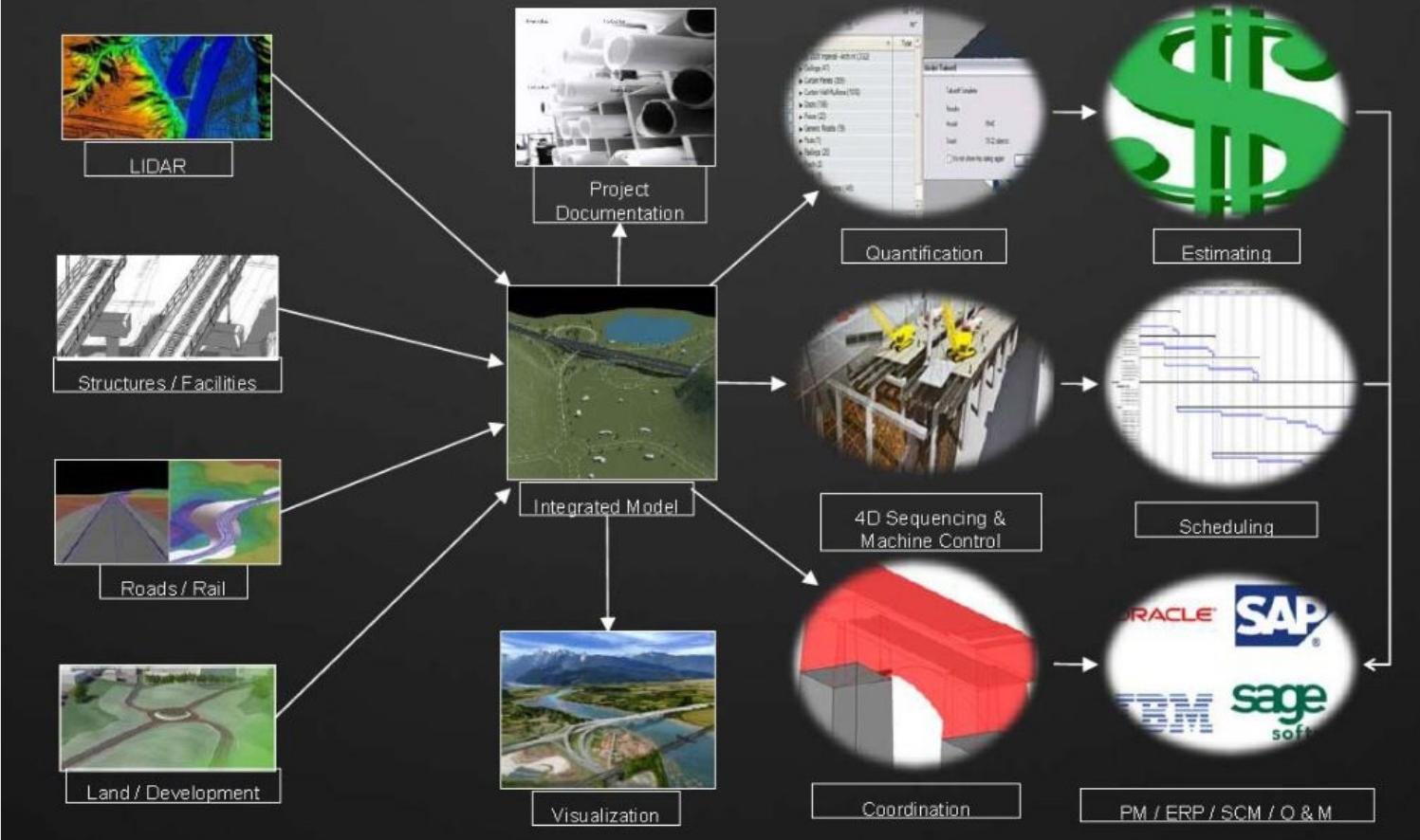
- Why use CIM?

- CIM can have great benefits in cost and time savings on projects
- CIM can improve information flow
 - Transparency among project stakeholders
 - Improve outreach to the public
- CIM can increase the effectiveness of agency professionals and service providers
 - Breach traditional silos
 - Improve information quality and availability
 - Increase productivity
 - Improve interfaces with contracted professionals





Heavy civil construction projects – BIM + geospatial



BIM for Sustainable Cities

Planning, Site Selection,
Conceptual Design



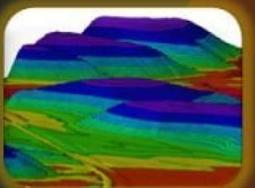
Surveying and
Data Collection



Multidiscipline
Coordination



Simulation
Analysis



Modeling &
Design



Construction
Documentation



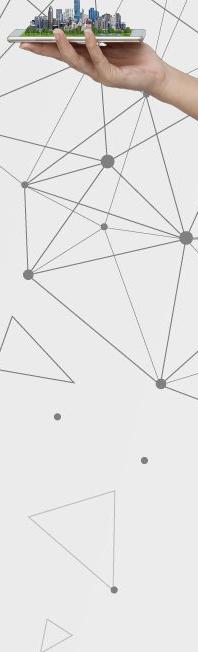
Visualization



Op. & Maint



Construction
Management



INTERNET OF THINGS IN CONNECTED CITIES

TRANSPORTATION CONGESTION SENSORS

Smart transportation systems use sensors to detect congestion and bottlenecks in traffic patterns. They also rely on cameras to enforce speed and traffic infractions. In doing so, these tools gather real time information that can be used by city DOTs to make mobility networks safer and more efficient.

WATER AND WASTEWATER MONITORING

Monitoring devices can detect leaks as well as changes in water pressure to determine whether water infrastructure is working properly.

PARKING APPS AND KIOSKS

Apps coordinate with smart parking meters to inform drivers of where there is parking availability.

BRIDGE INSPECTION SYSTEMS

Sensors monitor the structural soundness of bridges and inform city engineers of any issues. Drones are used to inspect hard to reach areas.

SELF-DRIVING CARS

Self-driving cars shuttle people in and out of the city, providing rides for others and making deliveries while their owners are occupied with work or other activities.

WASTE MANAGEMENT SENSORS

Sensors detect the amount of garbage in receptacles around the city so that sanitation workers can maximize efficiency in their routes.

LIGHTING

LED lights are weather adaptive and communications are automatically sent to the Department of Public Works when the bulbs need to be changed.

FIRE DETECTION

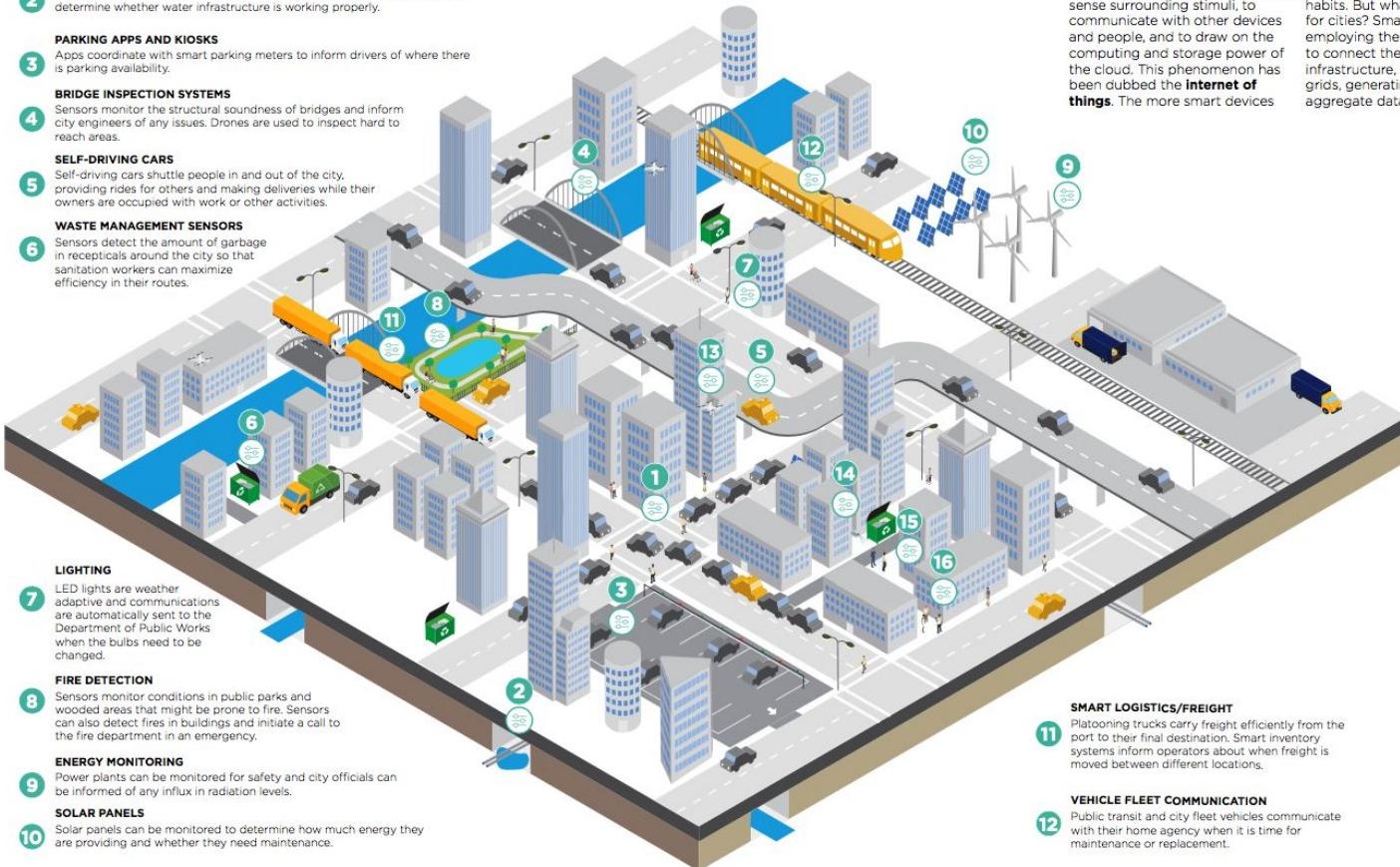
Sensors monitor conditions in public parks and wooded areas that might be prone to fire. Sensors can also detect fires in buildings and initiate a call to the fire department in an emergency.

ENERGY MONITORING

Power plants can be monitored for safety and city officials can be informed of any influx in radiation levels.

SOLAR PANELS

Solar panels can be monitored to determine how much energy they are providing and whether they need maintenance.



Every consumer product and piece of infrastructure increasingly has the ability to sense surrounding stimuli, to communicate with other devices and people, and to draw on the computing and storage power of the cloud. This phenomenon has been dubbed the **Internet of things**. The more smart devices

and sharing platforms there are, the more data is generated about consumer's preferences and habits. But what does this mean for cities? Smart cities are employing the same technology to connect their disparate utility, infrastructure, and public service grids, generating real-time aggregate data. This, in turn, can

help cities manage their programs and services more effectively and gauge their impact immediately. The city of the future is an interconnected one, where devices communicate with one another in a constant stream of data that provides real-time information to the public and to the municipality.

DRONES

Drones can be used for law enforcement and firefighting, as rural ambulances, for infrastructure inspections, and for environmental monitoring. Commercial uses include precision farming, aerial photography, and in the near future, package delivery.



SURVEILLANCE CAMERAS

Cameras ensure security by monitoring activity in areas that are not frequented by public safety officers. Areas that are not open to public access can be monitored to keep unauthorized personnel out.



BODY CAMERAS

Public safety officers can wear body cameras that capture footage of interactions between themselves and city residents to ensure safety for both parties.



WEARABLE DETECTION

Cities can build in smartphone and wearable detection sensors so that people can be an active part of the internet ecosystem, communicating with the city, and with each other.



BROADBAND INFRASTRUCTURE

A reliable internet ecosystem is the glue that holds the internet of things together.



Smart Enterprise Monitor

enterprise Digital Twins driven by AI, Big Data and IoT to assist owners and operators in holistic management and control of complex business processes in manufacturing, services and distribution, condition monitoring to improve performance, efficiency and sustainability

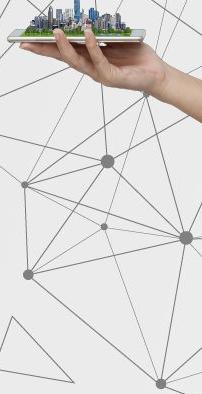
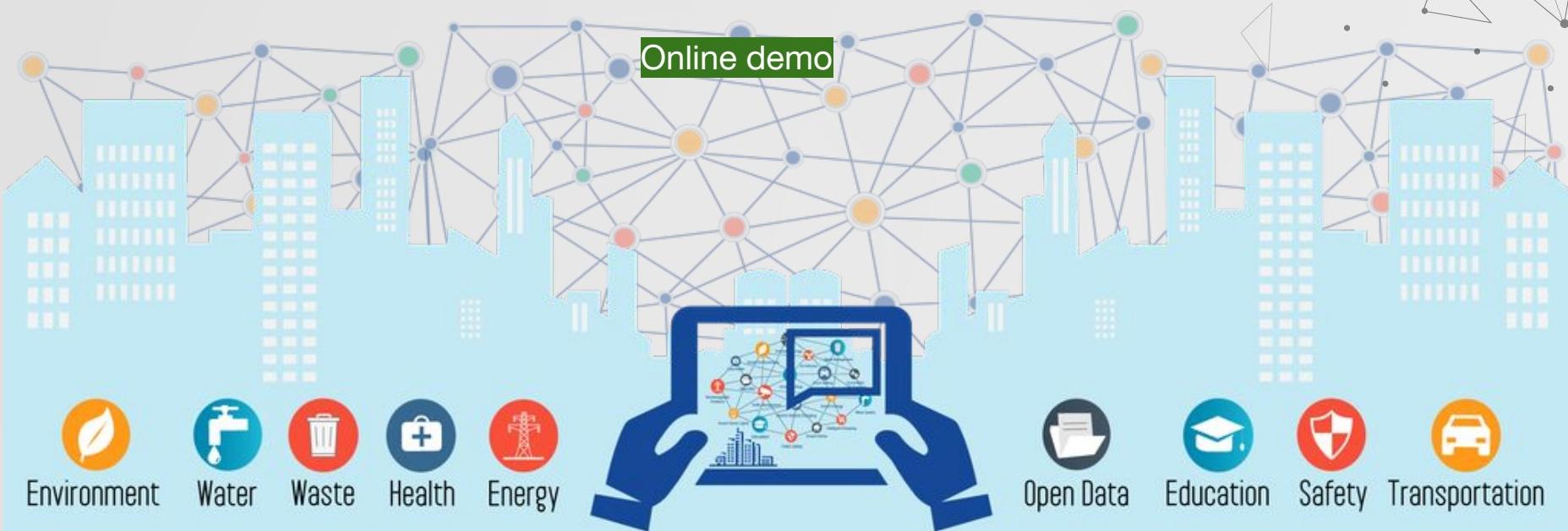


Online demo



Smart City Monitor

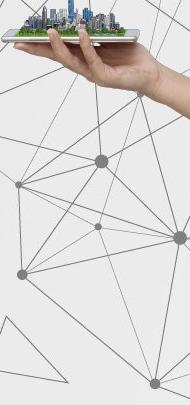
powerful Digital Twins for urban areas driven by AI, Big Data and IoT to assist governing bodies, administrations, utility providers and citizens improving quality of life, its sustainability, resource efficiency and transparency of processes and achievements



IoT Integrator tools for rapid development of intelligent custom solutions

tools for system integrators to make and run complex tailored IoT, AI and Big Data.solutions using big real time data from diverse sensors, automated systems and mobile apps in physical and virtual worlds to provide customers with holistic monitoring and analytics

Online demo

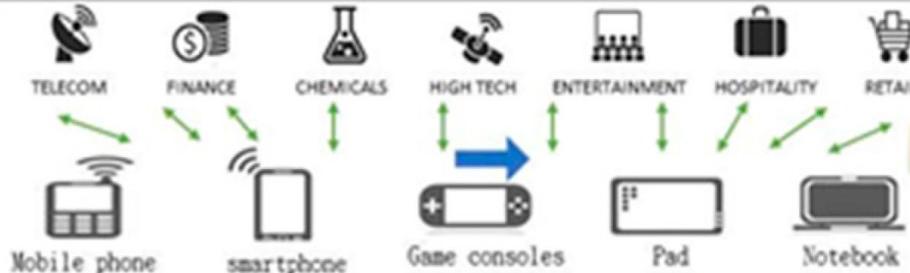




I.O.C (Intelligent operations center)



Data to asset



Smart business

Mobile Network

Internet

TB+



Transaction data



PB+



Behavior log data

Converged data Platform

ORACLE

TERADATA

IBM
NETWEKA

Mobile
Network



Social network

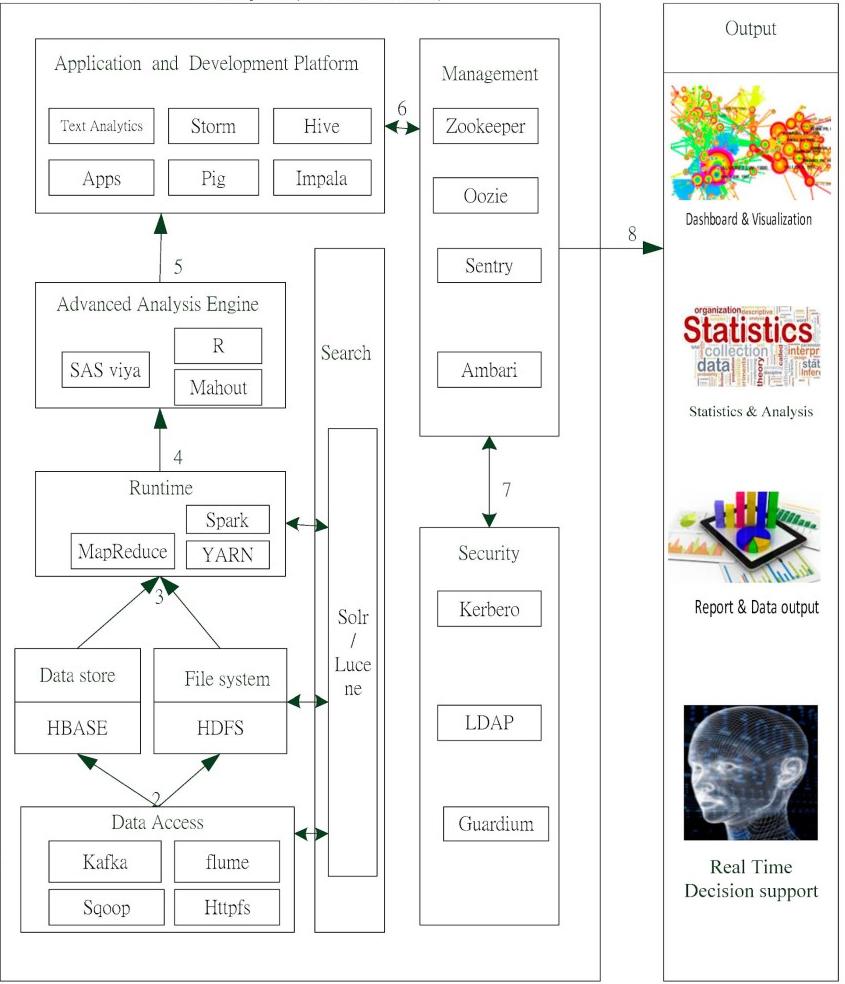
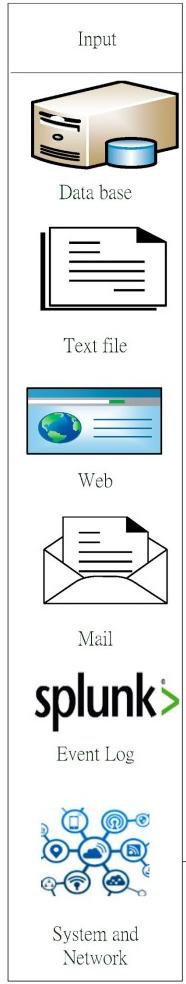
Cloud computing

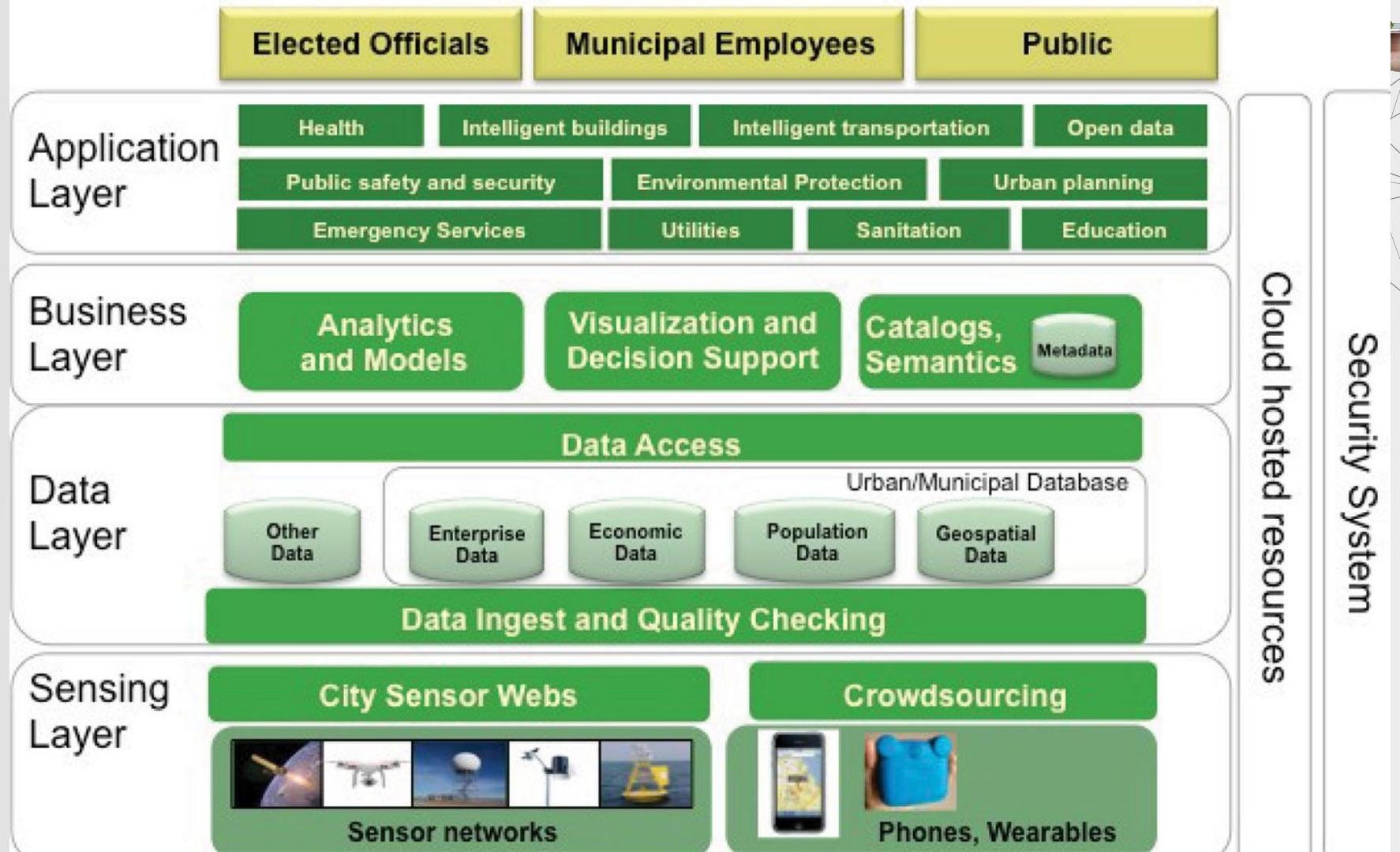


RFID GIS

Internet of Things

Big Data
DataLake Ecosystem(base on HADOOP)





Open Street Map Egypt

- Geo-data is not free
- In most countries you must pay the national mapping agency to license the data
- To buy the entire Ordnance Survey National database of the UK would cost £50 Million (€73 Million)
- "The OpenStreetMap Foundation is an international non-profit organisation dedicated to encouraging the growth, development and distribution of free geospatial data and to providing geospatial data for anybody to use and share."



What is OSM?

- Not software
- One world-wide geographic database with many contributors – “GeoWiki”
- Focus on streets – but also other features like land cover and POI
- Geometry types: Nodes, ways and closed ways (“areas”) Relations – group of geometries (Data Primitives)
- GPS-measured – quite good accuracy but not so detailed
Stored in latitude/longitude – rendered in spherical Mercator projection
- Map Features with defined tags (common and extensible object model)
- Profiles like OpenCycleMap (specific tags and rendering)
- Open Geo Data
- There are many “free” basemaps, Google, Yahoo, Bing...
- ○ These only give limited rights of use
- OSM gives users rights to any kind of reproduction or processing
- Creative Commons license

Methodology

People, like you and me, gather location data across the globe from a variety of sources such as:

- . Recordings from GPS devices
- . Public domain data
- . Digitizing against free satellite imagery

This information then gets uploaded to OpenStreetMap's central database from where it can be further modified, corrected and enriched by anyone who notices missing facts or errors about the area.



Who owns OSM data?

Collaboration – the contributors are the owners, with the Creative Commons Attribution/ShareAlike license (CC-BY-SA 2.0)

- Anyone can copy OSM data
- But if you incorporate it into something else, that “something else” also has to be copiable under the same terms and conditions (ShareAlike)
- When you copy it, you have to give credit to the copyright owner (Attribution)

Supporting, not controlling:

OpenStreetMap Foundation, www.osmfoundation.org

Why?

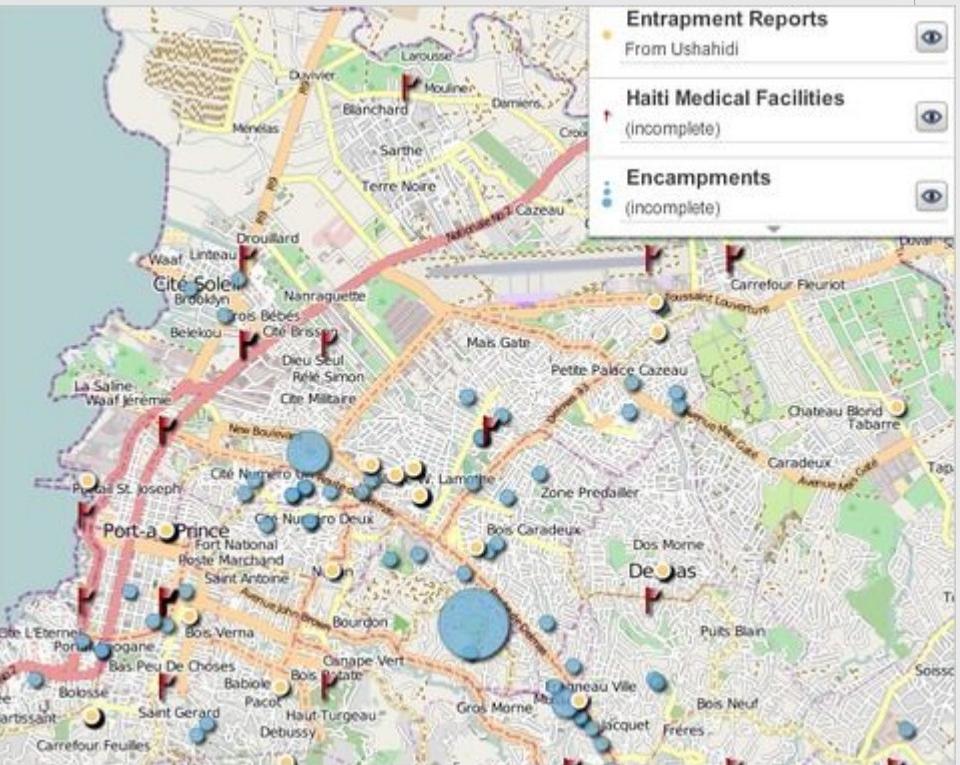
Geodata is expensive, difficult to order and to use
Especially true for vector data (and orienteering map data ...)
Object models are not standardized (ISOM is a notable exception)
“Free” alternatives (e.g. Google Maps) are proprietary

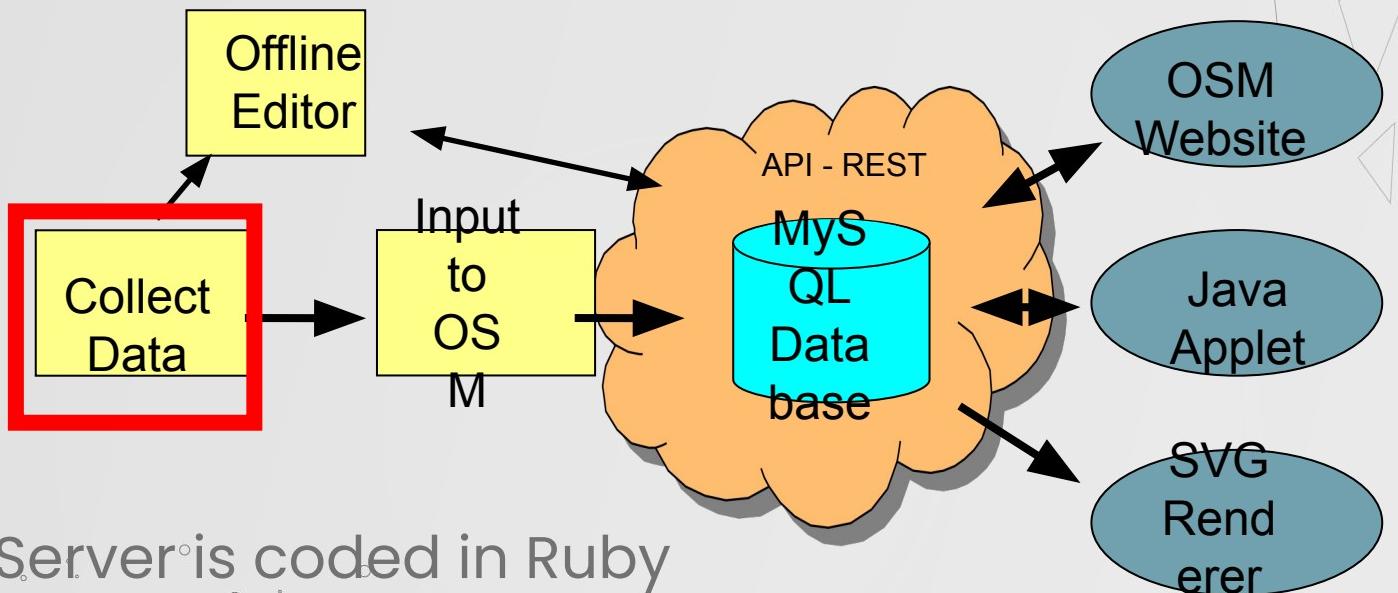
How?

- Database – PostgreSQL (earlier MySQL)
- Editors – Potlatch (Flash), JOSM (Java), Merkaator (Qt, i.e. C++)
 - Interactive editing (GPS tracks) and batch import
- Renderer – Mapnik (out: raster tiles) and Osmarender (out: SVG)
- Runs on Linux, Mac and Windows
- OpenSource – all software (except maybe OS)



Digital Help for Haiti





- Server is coded in Ruby
- The entire site is currently being transferred to Rails

Getting the data – the OSM way

Step 1 – Collect data using a GPS receiver

- We cannot use copyrighted maps to get street name information. So...



Getting the data - the OSM way

Step 2 – Convert to GPX format (we recommend GPSBabel)

```
<?xml version="1.0"?>
<gpx
  version="1.0"
  creator="GPSBabel - http://www.gpsbabel.org"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.topografix.com/GPX/1/0"
  xsi:schemaLocation="http://www.topografix.com/GPX/1/0 http://www.topografix.com/GPX/1/0/gpx.xsd
  <name>2008-05-17 2013024</name>
  <trk>
    <trkseg>
      <trkpt lat="51.620372252" lon="-0.232705151">
        <ele>13.15112</ele>
        <time>2008-05-17T11:07:09Z</time>
      </trkpt>
    </trkseg>
  </trk>
</gpx>
```





OSM XML - http://wiki.openstreetmap.org/wiki/OSM_XML

```
<osm version="0.6" generator="Osmosis SNAPSHOT-r26543">
  <bound box="34.01978,-117.22435,34.08958,-117.13878" origin="Osmosis SNAPSHOT-r26543">
    <node id="1487903542" version="1" timestamp="2011-10-31T22:52:01Z" uid="409545" user="xx">
      <tag k="name" v="180 Chiropractic"/>
      <tag k="amenity" v="doctors"/>
    </node>
    ...
    <way id="1388479497" version="1" timestamp="2011-11-29T00:20:18Z" uid="304970" user="xx">
      <nd ref="1522479496"/>
      <nd ref="1522479499"/>
      <nd ref="1522479502"/>
      <nd ref="1522479504"/>
      <nd ref="1522479496"/>
      <tag k="building" v="yes"/>
    </way>
    ...
    <relation id="13076706" version="2" timestamp="2012-09-11T23:31:01Z" uid="194231" user="xx" changeset="13076706">
      <member type="way" ref="172454568" role="forward"/>
      <member type="way" ref="29001116" role="forward"/>
      ...
      <tag k="ref" v="10"/>
      <tag k="symbol" v="http://upload.wikimedia.org/wikipedia/commons/c/c3/I-10_%28CA%29.svg"/>
      <tag k="direction" v="west"/>
      <tag k="route" v="road"/>
      <tag k="name" v="I 10 (CA westbound)"/>
      <tag k="is_in:state" v="CA"/>
      <tag k="wikipedia" v="en:Interstate 10 in California"/>
      <tag k="type" v="route"/>
      <tag k="network" v="US:1"/>
    </relation>
```

version of the API (the features used) and the generator that distilled this file

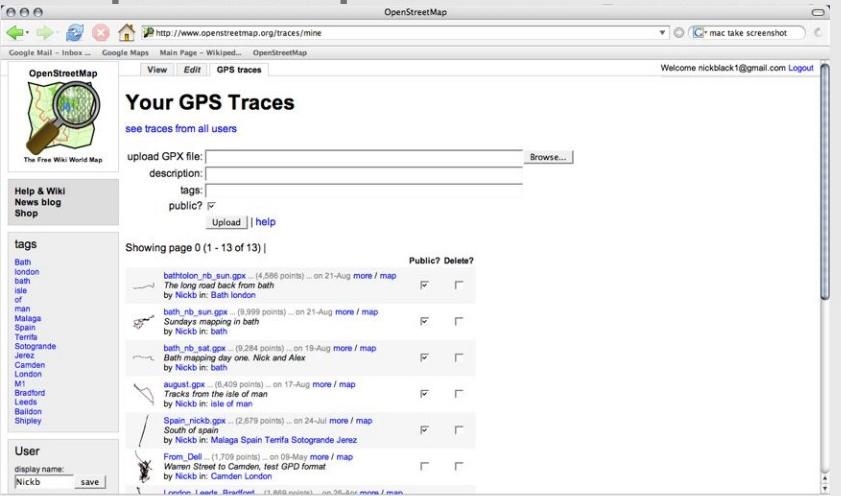
Node: location, and tags

Way: references to its nodes for each way, and tags

Relation: references to its members for each relation, and tags

Getting the data – the OSM way

Step 3 – Upload to OSM



The screenshot shows the 'Your GPS Traces' page on the OpenStreetMap website. At the top, there's a search bar and a map icon. Below it, a sidebar on the left lists various locations: Bath, London, Bath, Isle of Man, Malaga, Spain, Tempra, Sotogrande, Jerez, Cadiz, London, M1, Bradford, Leeds, Baldon, Shipley. A 'User' section shows 'display name: Nickb' and a 'save' button. The main area displays a list of uploaded GPX files:

- bath,lon_nb_sun.gpx - (4,586 points) ... on 21-Aug more / map
- The long road back from bath by Nickb in: Bath, London
- bath_nb_sun.gpx - (9,899 points) ... on 21-Aug more / map
- Sun mapping day one by Nickb in: bath
- bath_nb_sat.gpx - (9,284 points) ... on 19-Aug more / map
- Bath mapping day one. Nick and Alex by Nickb in: bath
- august.gpx - (6,409 points) ... on 17-Aug more / map
- Tracks from the isle of man by Nickb in: man
- Spain_nicks.gpx - (2,879 points) ... on 24-Jul more / map
- South of spain by Nickb in: Malaga Spain Tempra Sotogrande Jerez
- From_Dell - (1,709 points) ... on 09-May more / map
- Warren Street to Camden, test GPD format by Nickb in: Camden London
- London_Laure_Brownfield - (1,810 points) ... on 28-Aug more / map

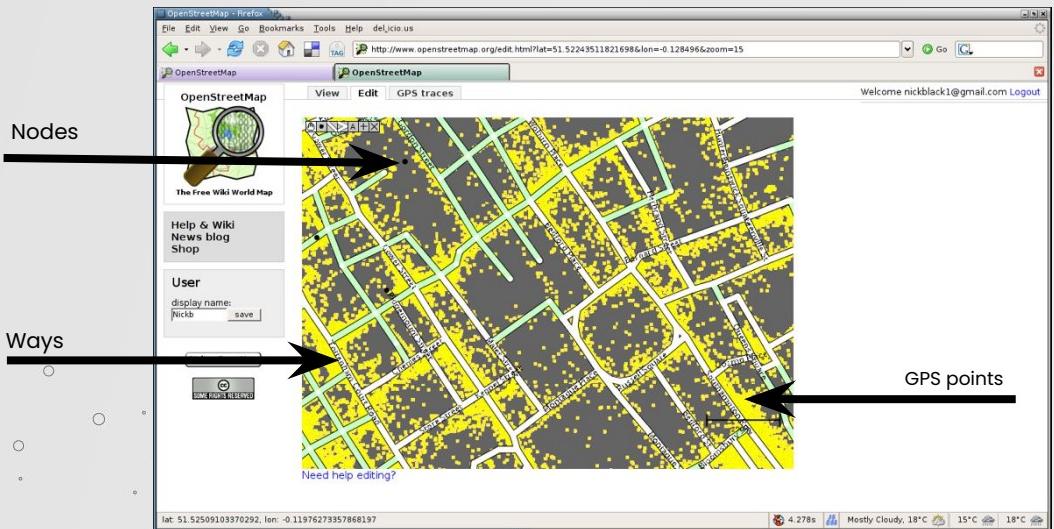
• Data is instantly available via
the web portal or the API



Getting the data - the OSM way

Step 4 - Edit the data

- Java applet allows basic editing: creating, naming and deletion of ways and segments





The OpenStreetMap feature is in beta until further notice.



Water

Earth

Buildings

Landuse

Roads

Buildings minimal height

Randomize Buildings Height



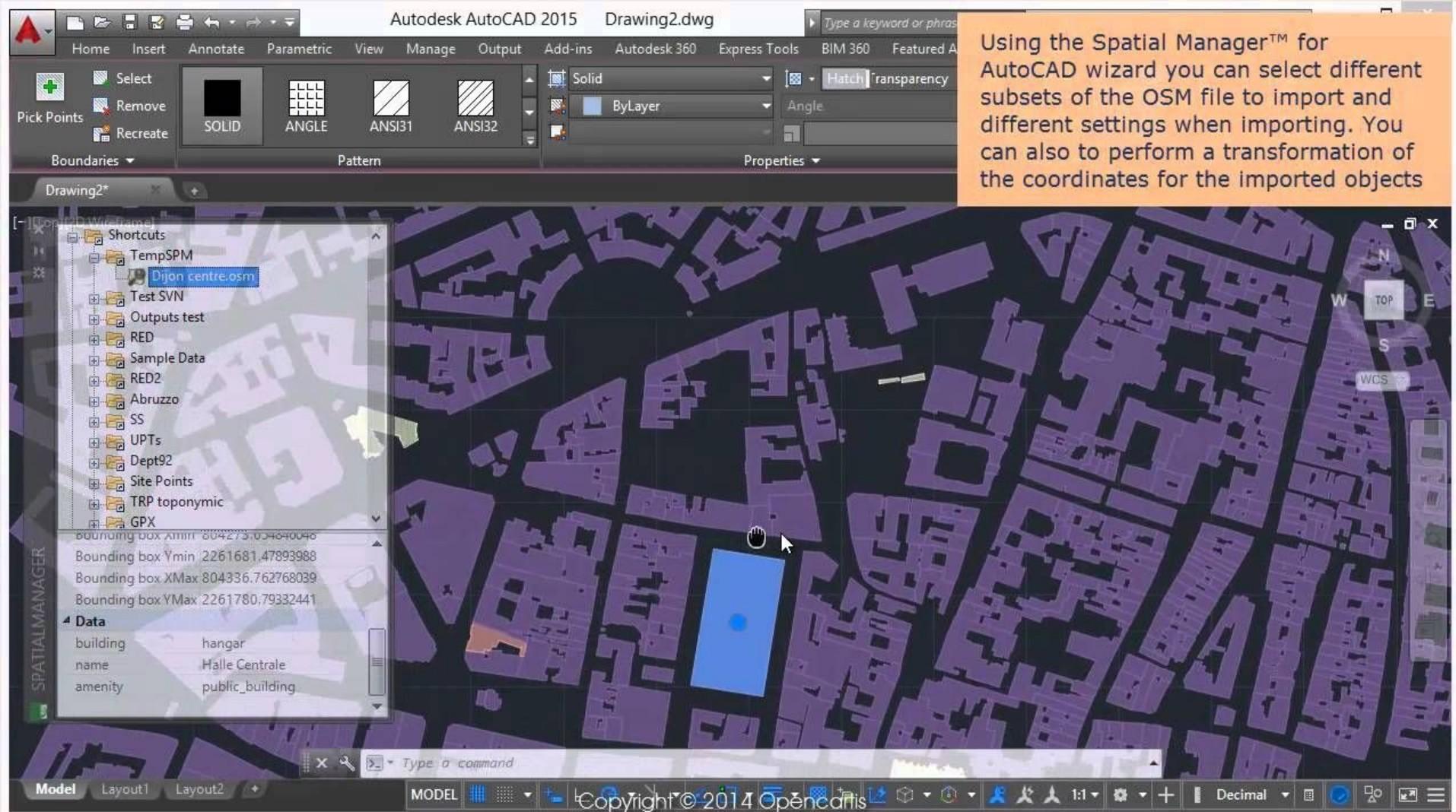
The OpenStreetMap feature is in beta until further notice



52°22'23.4"N 4°53'26.4"E

© OpenStreetMap contributors



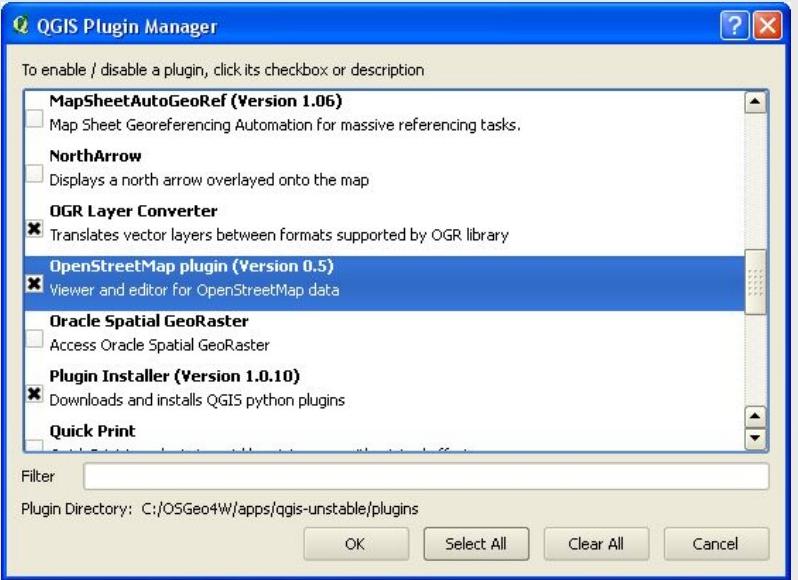


Using the Spatial Manager™ for AutoCAD wizard you can select different subsets of the OSM file to import and different settings when importing. You can also perform a transformation of the coordinates for the imported objects

CyberCity 3D buildings in London compared to OSM models (as seen in Autodesk InfraWorks 360)

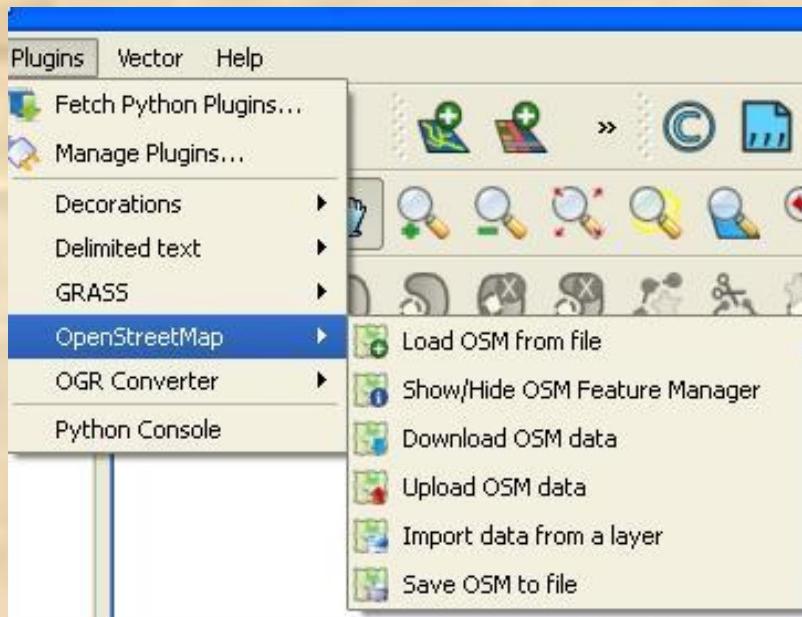
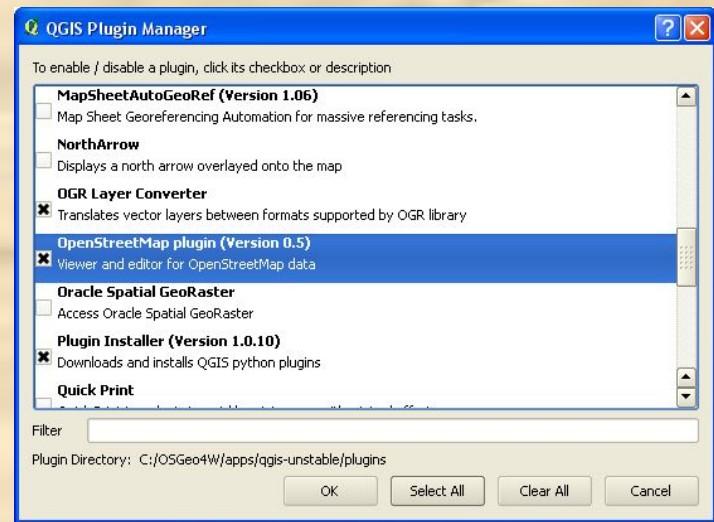


QGIS OSM Plug In



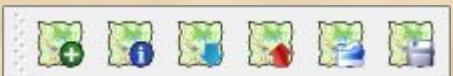
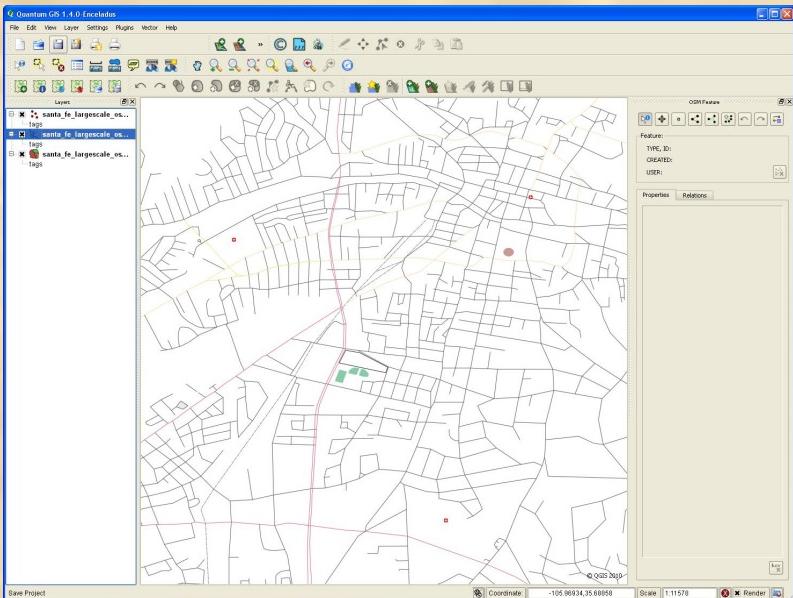
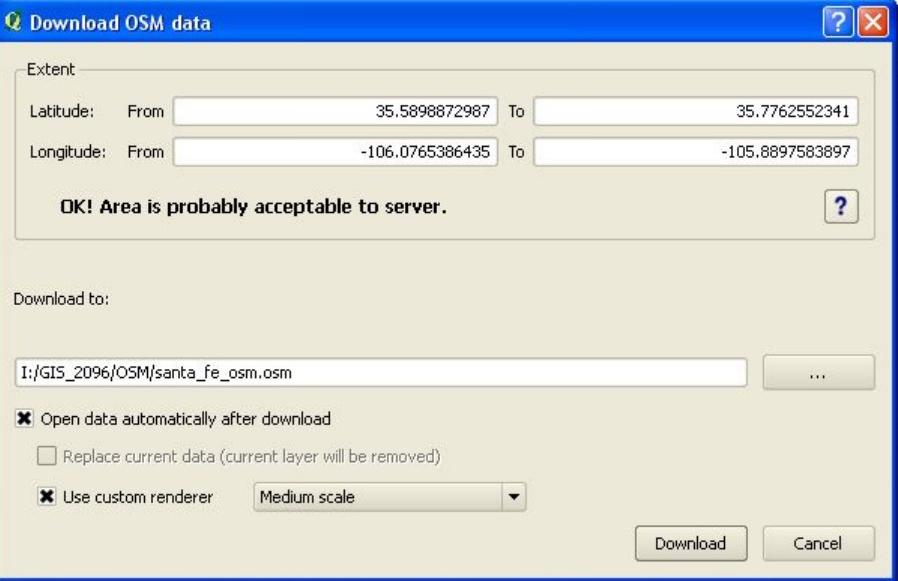


QGIS OSM Plug In





QGIS PlugIn



OSM in ArcGIS



A screenshot of a software window titled "Add Basemap". The window displays a grid of nine map preview images, each with a caption below it. The maps include Bing Maps Aerial, Bing Maps Hybrid, Bing Maps Road, DeLorme, Imagery, OpenStreetMap (selected), Physical, Shaded Relief, Streets, Terrain, Topographic, and USA Topo Maps. At the bottom right are "Add" and "Cancel" buttons.



Editing OSM in ArcGIS

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Open Source Community

ArcGIS Editor for OpenStreetMap

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[Search Wiki & Documentation](#)

The ArcGIS Editor for OpenStreetMap is designed to help ArcGIS Desktop 10 users to become active members in the growing community of users building an open and freely available database of geographic data.

The provided tools allow you to download data from the OSM servers and store it locally in a geodatabase. You can then use the familiar editing environment of ArcGIS Desktop to create, modify, or delete data. Once you are done editing, you can post back the edit changes to OSM to make them available to all OSM users.

This site provides access to the released versions of the ArcGIS Editor for OpenStreetMap (OSMEditor), the source code, as well as documentation and issue tracker.

Last edited Jul 8 2010 at 7:15 PM by [mhogeweg](#), version 6

[Home](#)

Project Description

★ 28 people are following this project ([follow](#))

Download

CURRENT ArcGIS Editor for OpenStreetMap 1.1
DATE Wed Apr 20 2011 at 1:00 AM
STATUS Stable
RATING ★★★★★ 1 rating
1828 downloads
[View all downloads](#)

Recent reviews ([more](#))

★★★★★ arcmap Google Earth

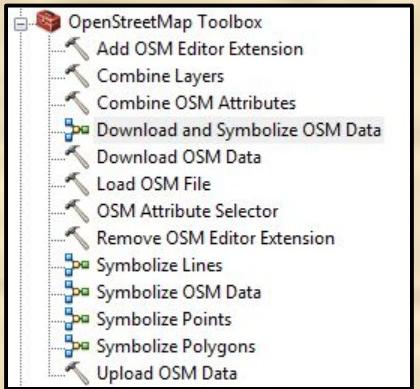
Activity [All days](#)

Page Views	1227
Visits	378
Downloads	205
Application Runs	N/A

[View Detailed Stats](#)



Download OSM in ArcGIS



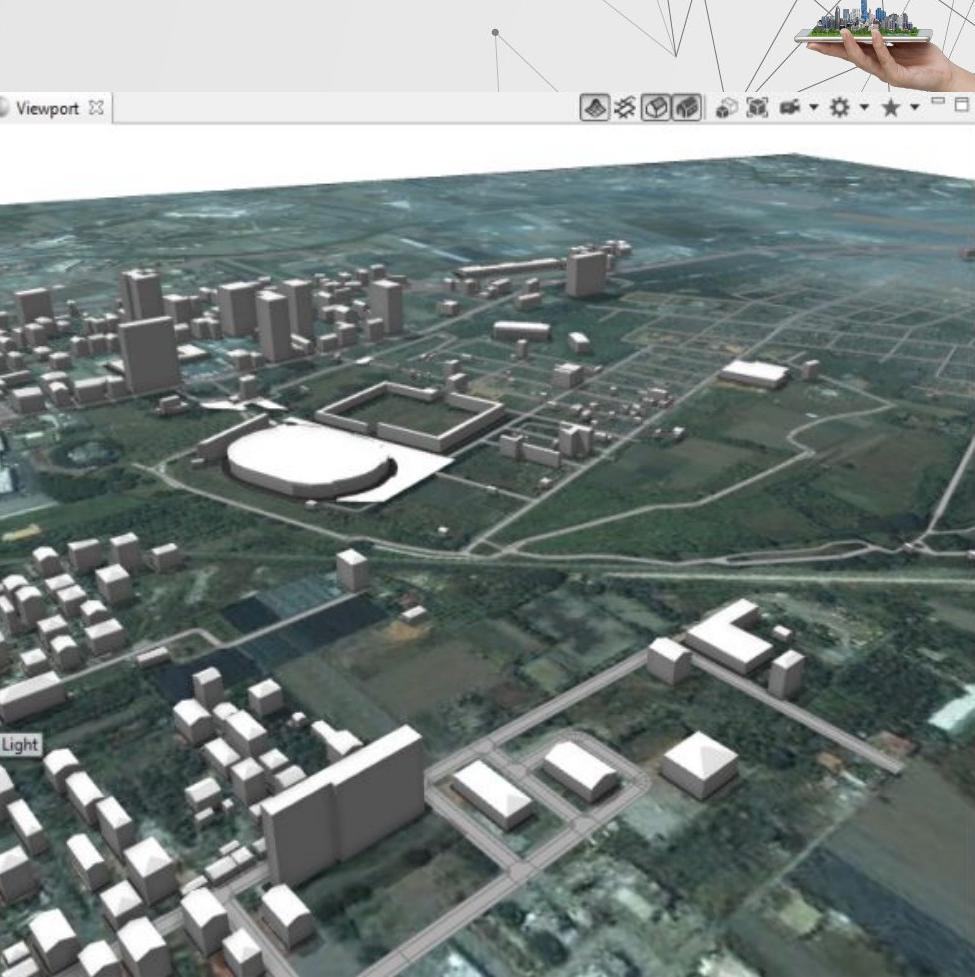
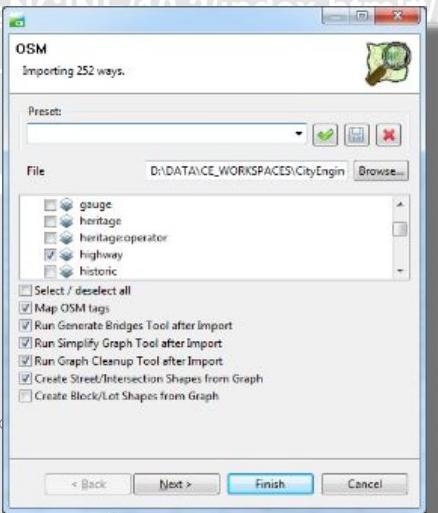
Screenshot of ArcMap showing the downloaded OSM data. The map displays a coastal area with various land parcels, roads, and water bodies. The data is categorized into several layers:

- OSM Group Layer**:
 - OSM Downloaded Points
 - Aeroway (Points)
 - Barrier (Points)
 - Geological (Points)
 - Historic (Points)
 - Leisure (Points)
 - Landuse (Points)
 - Place (Points)
 - Railway (Points)
 - Tourism (Points)
 - Waterway (Points)
 - Shop (Points)
 - Power (Points)
 - Natural (Points)
 - Man made (Points)
 - Land use (Points)
 - Highway (Points)
 - Building (Points)
 - Amenity (Points)
 - Religion (Points)
 - Religious (Points)
 - OSM Downloaded Lines
 - Power (Lines)
 - Barrier (Lines)
 - Route (Lines)
 - Man Made (Lines)
 - Leisure (Lines)
 - Natural (Lines)
 - Waterway (Lines)
 - Boundary (Lines)
 - Tourism (Lines)
 - Amenity (Lines)
 - Religion (Lines)
 - Airway (Lines)
 - Railway (Lines)
 - Highway (Lines)
 - OSM Downloaded Polygons
 - Waterway (Polygons)
 - Place (Polygons)
 - Power (Polygons)
 - Historic (Polygons)
 - Aeroway (Polygons)
 - Barrier (Polygons)
 - Landuse (Polygons)
 - Man made (Polygons)
 - Shop (Polygons)
 - Amenity (Polygons)
 - Highway (Polygons)

Data to access

- City Engine (see
<http://resources.arcgis.com/EN/HELP/CITYENGINE/10.2/index.html#/02w100000000>)

- Produ



Contributions welcome

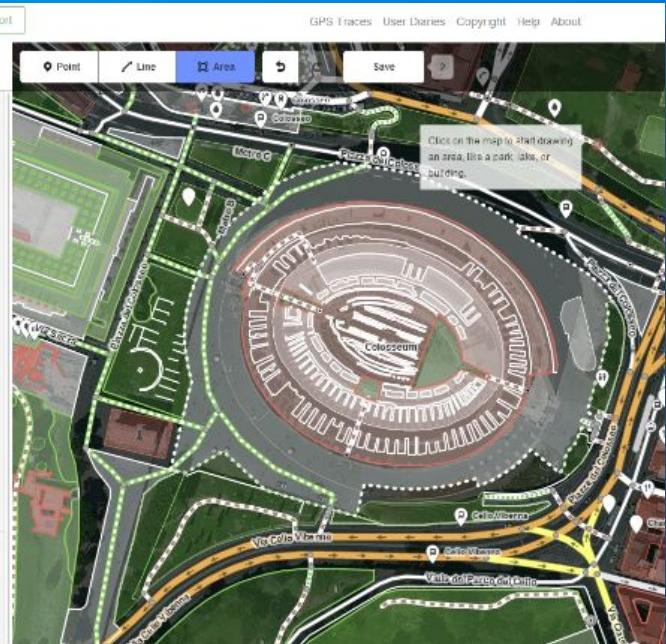
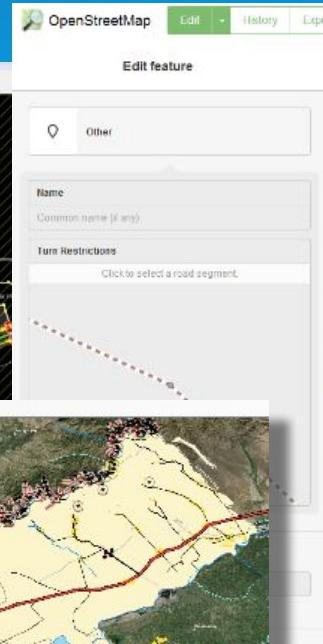
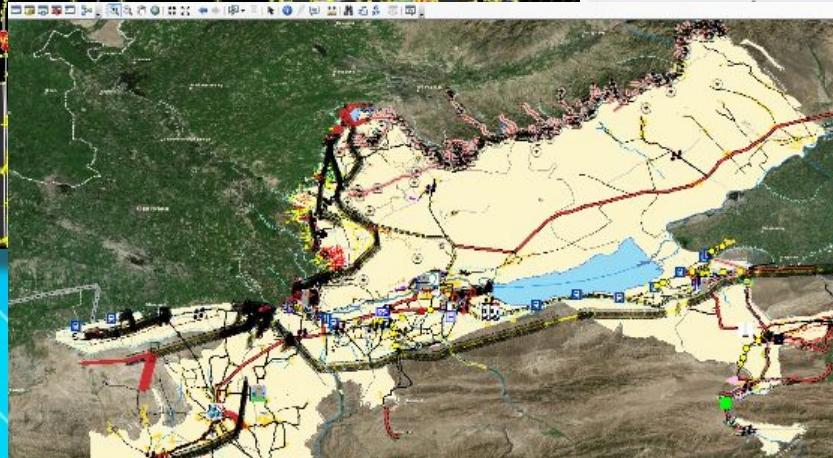
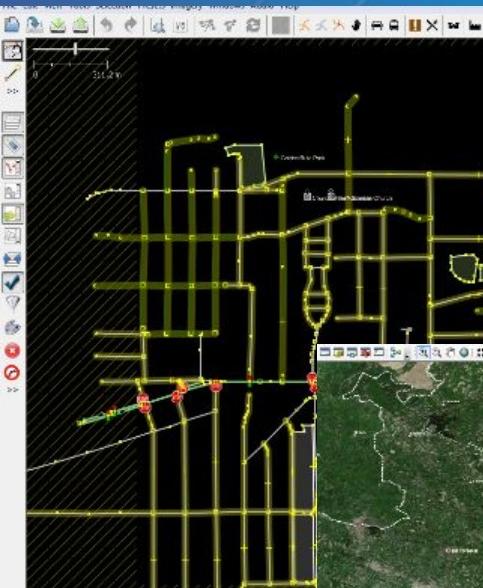
https://wiki.openstreetmap.org/wiki/Mapping_projects





Many tools to contribute data to OSM

<http://wiki.openstreetmap.org/wiki/Editing>





ArcGIS Editor for OpenStreetMap

[Download free from ArcGIS Online](#)

ArcGIS Editor for OSM, 10.3.x Desktop



ArcGIS for Desktop tools that support using OpenStreetMap data in ArcGIS. Load .osm files, apply symbology, contribute data back to OSM, and create network datasets from OSM data.

 Geoprocessing Sample by ceggers

Last Modified: April 3, 2015

 (0 ratings, 3,508 downloads)

[Sign in to rate this item.](#)

 Facebook  Twitter

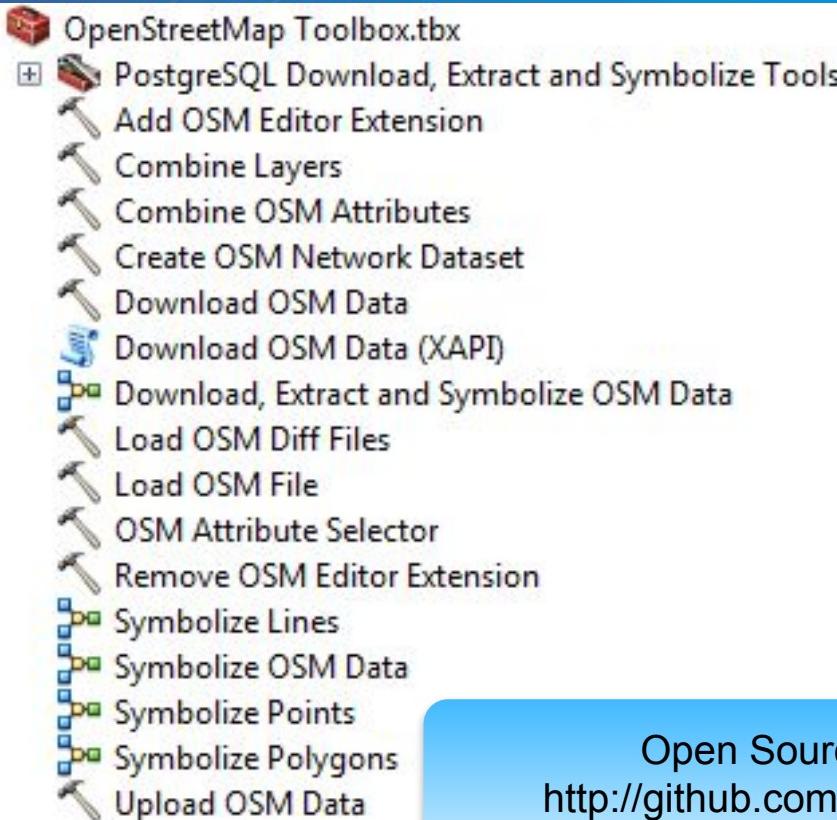
[OPEN ▾](#)

- **10.3.x and 10.2.2 update:**

<https://github.com/Esri/arcgis-osm-editor/wiki/Release-Notes>



What does ArcGIS Editor for OSM do?

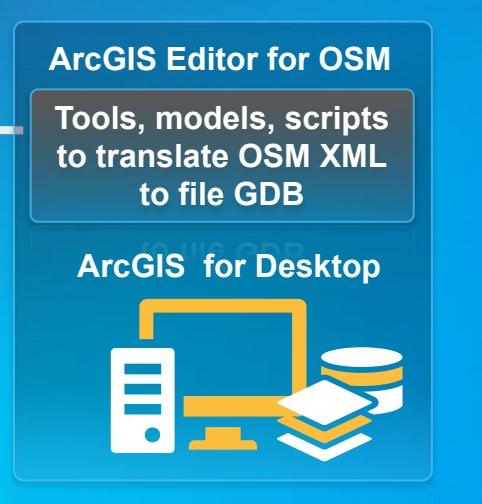


- Translate OSM data into a feature dataset you can use in ArcGIS
- Make a Network Dataset from OSM data
- Support users to contribute data to OSM through ArcMap Editing workflows

Open Source and on github:
<http://github.com/Esri/arcgis-osm-editor>

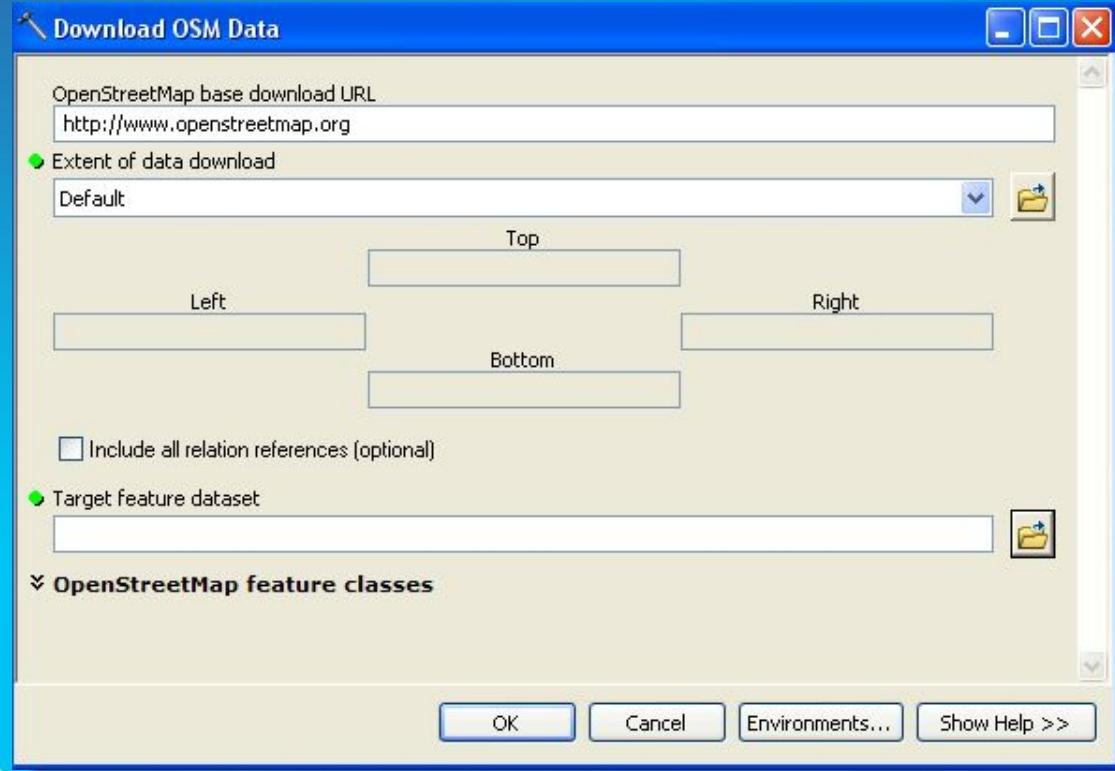


ArcGIS Editor for OSM Architecture



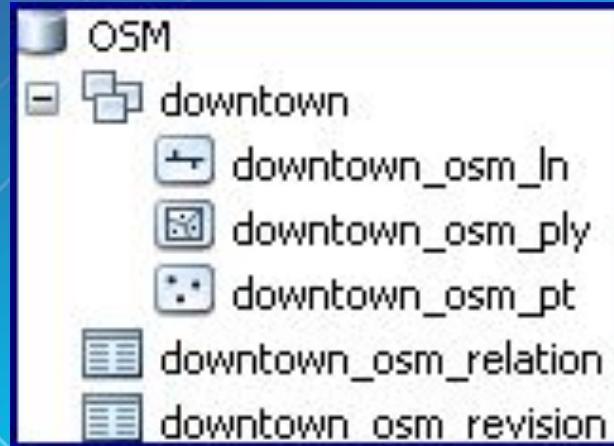


Download OSM Data tool





Resulting feature classes and tables



- **osm_relation**

- Maintains relations between features as described in OSM as the user works with the OSM data in ArcGIS
- E.g., primary, secondary, and residential types of road line features may have a relation to describe how these define a bus route

- **osm_revision**

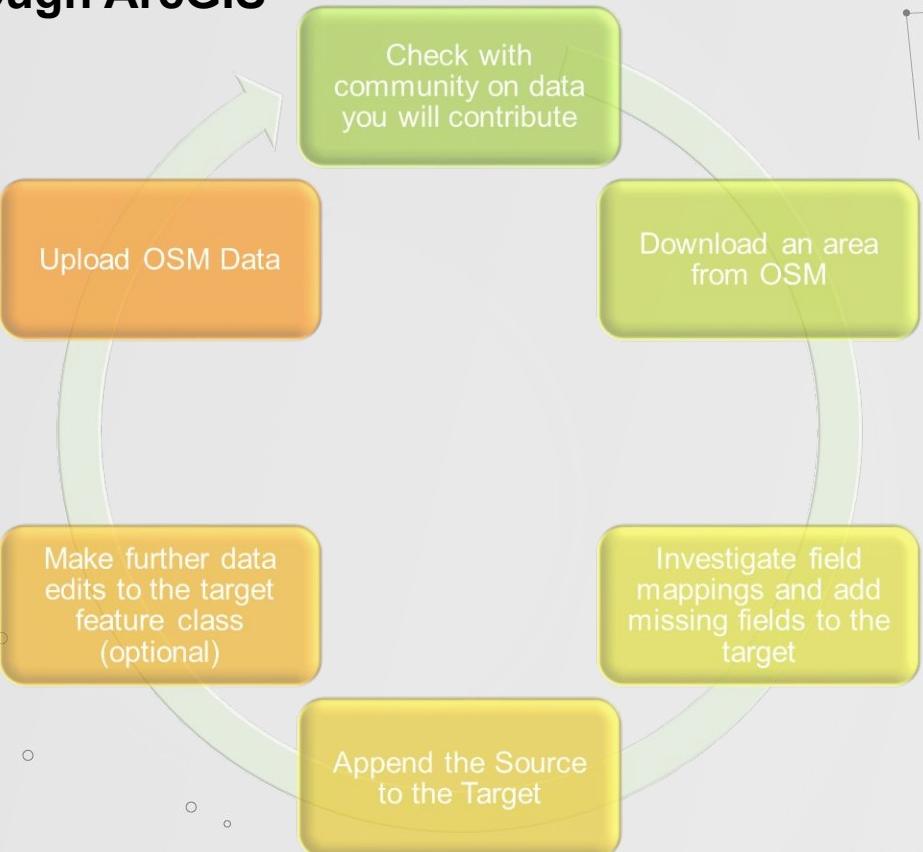
- Track edits to the downloaded OSM dataset that are made by you as you edit it
- Used if you choose to upload data back to OSM

Editing using the ArcGIS OSM Editor

Demo



Contributing an existing dataset to OSM through ArcGIS



Lots of creative tools and products out
there



Want to find out more?

- www.openstreetmap.org
- www.opengeodata.org
- OpenGeoData <http://opengeodata.org/>
- OSM Streetview
- Open Aerial Map
- Free Earth Foundation
- NASA World Wind
- <http://www.freeearthfoundation.com/> (NASA World Wind)
- Open knowledge Foundation <http://www.okfn.org/>
- The Map <http://www.openstreetmap.org/>
- Wiki http://wiki.openstreetmap.org/wiki/Main_Page
- Planet OSM <http://wiki.openstreetmap.org/wiki/Planet.osm>
- Twitter @openstreetmap
- QGIS
- http://www.qgis.org/wiki/Using_OpenStreetMap_data
- OSM → PostGIS



BIM workflow

- BIM enable **Everyone** - access - **All Project Data** at **Anytime**

(Common Data Environment)

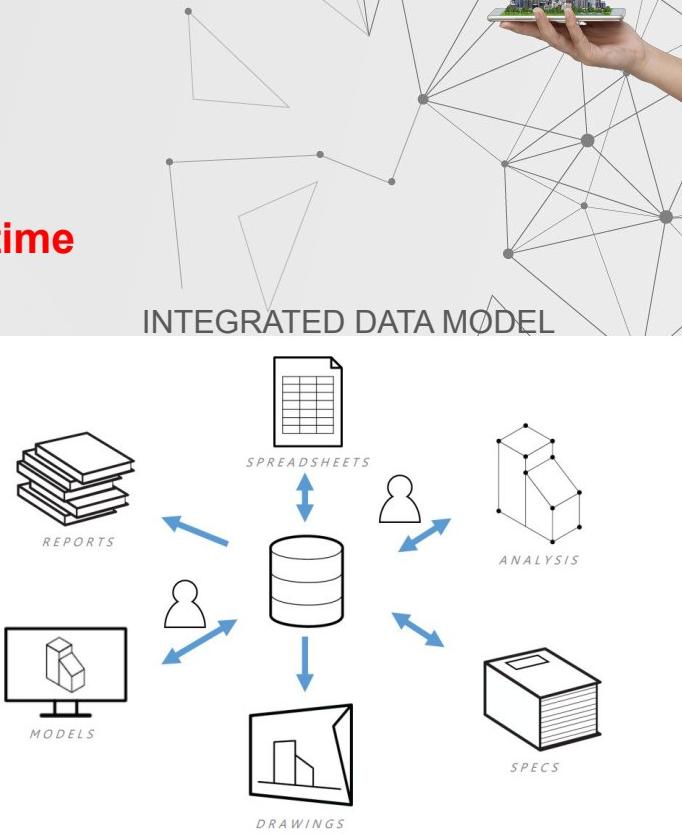
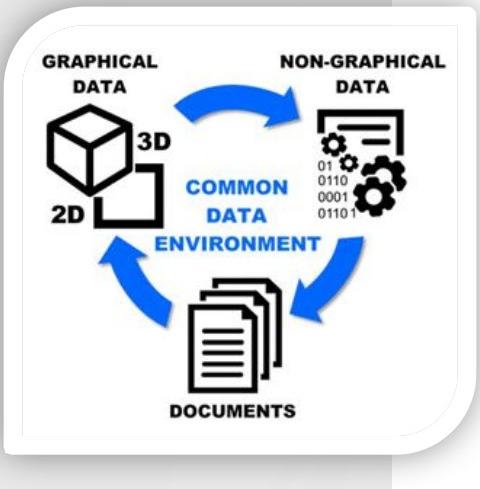
(BIM platform)

Cloud-based.

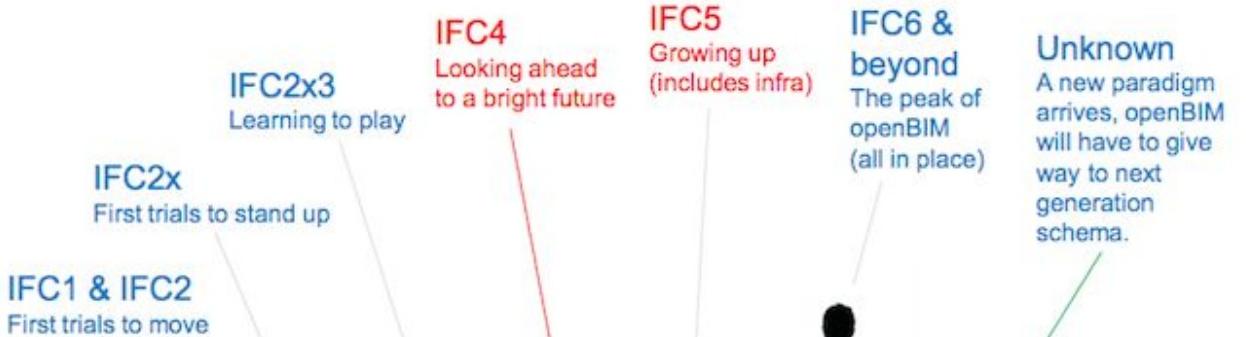
Manage user access.

Host different file formats.

Integrate a 3D BIM model viewer.



BIM is about sharing information and working together



S. Keenlside
T. Liebich
F. Grobler
©2012

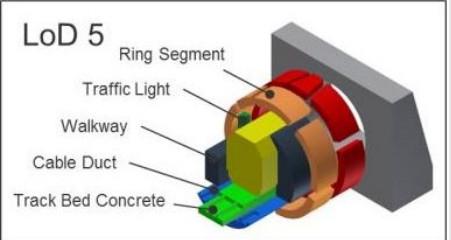
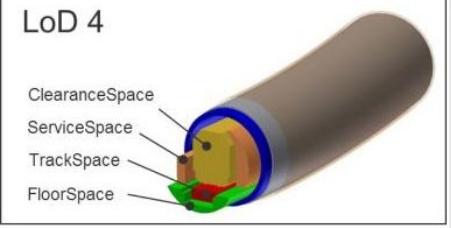
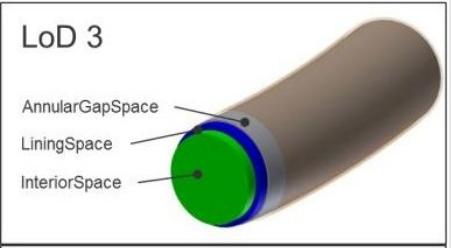
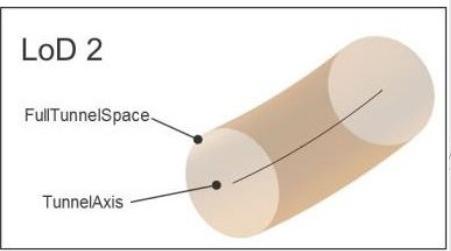
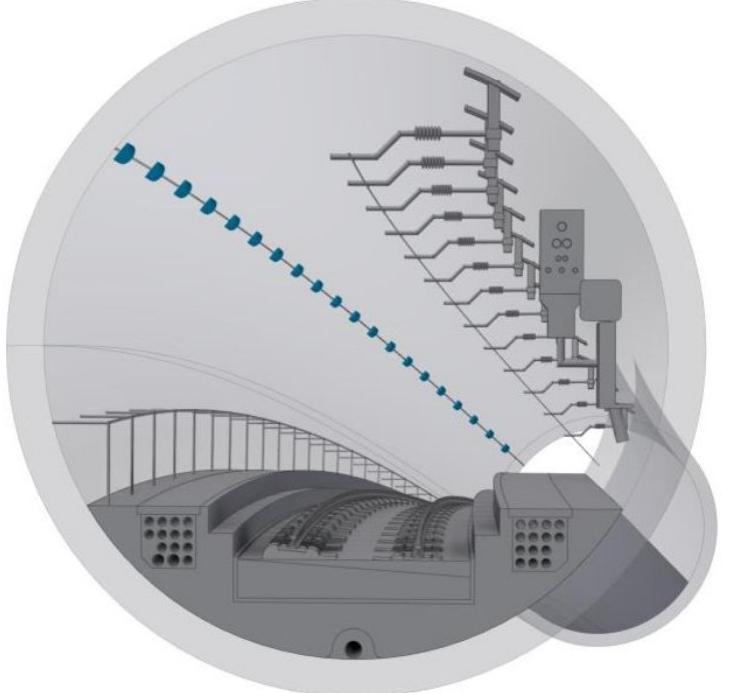
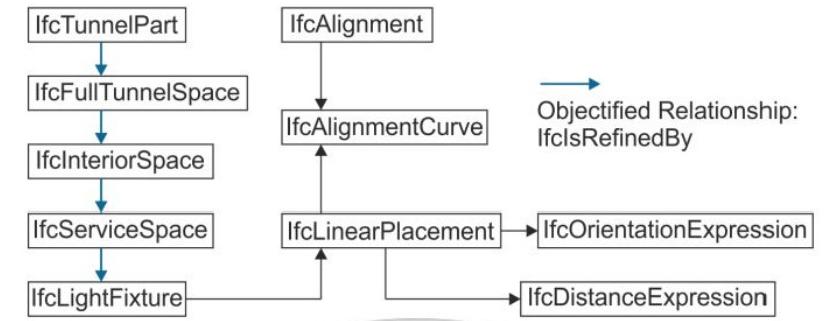


Figure 1: Placement of lighting objects in the visualization of a IFC tunnel model at LoD 4 of the 5 LoD Range.

3 Stages of 3D Digital Map Development

Stage 1

- 3D maps for visualization



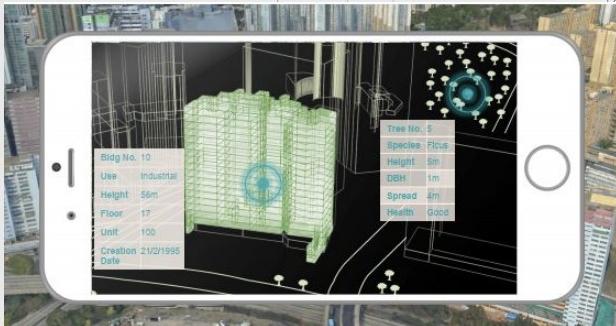
Stage 2

- 3D maps for floor/unit-based indoor applications



Stage 3

- 3D maps for city modelling



With a *BIM for Sustainable Cities* plan, municipalities
are better able to:

- Coordinate with architects, engineers, contractors and others
- Better share digital design information, geospatial data, infrastructure models and other documentation among staff and project stakeholders
- Use that information to accurately predict performance, appearance and cost
- Reliably deliver municipal projects faster, more economically and with reduced environmental impact
- Leverage model-based design information for operation and maintenance

LiDAR/Laser Scan to BIM



- Creating of 3D BIM models with point cloud data generated from laser scanning
- Production of as-built CAD drawings from the generated models
- Beneficial for Renovation, Refurbishment / Retrofitting of existing structures

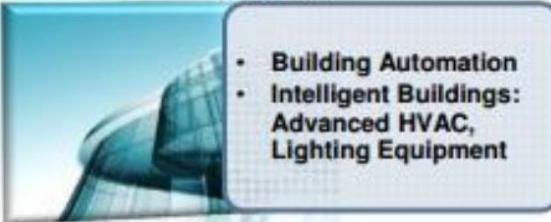


Smart Energy: Digital Management of Energy



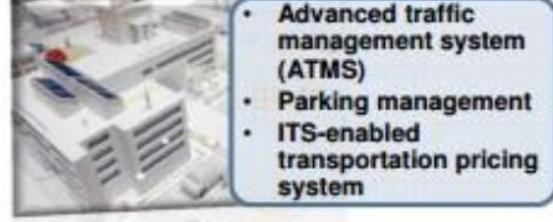
- Smart grids
- Smart meters
- Intelligent energy storage

Smart Buildings: Automated Intelligent Buildings



- Building Automation
- Intelligent Buildings: Advanced HVAC, Lighting Equipment

Smart Mobility: Intelligent Mobility



- Advanced traffic management system (ATMS)
- Parking management
- ITS-enabled transportation pricing system

Smart Technology*: Seamless Connectivity



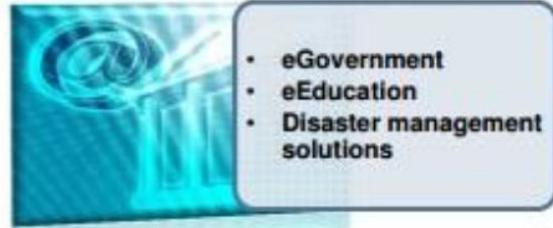
- 4G connectivity
- Super broadband
- Free Wi-Fi
- 1Gbps download speeds

Smart Infrastructure: Digital Management of Infrastructure



- Sensor networks
- Digital water and waste management

Smart Governance and Smart Education: Government-on-the-Go



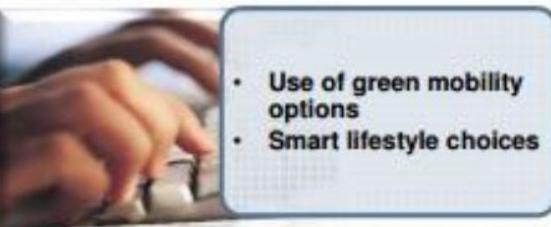
- eGovernment
- eEducation
- Disaster management solutions

Smart Healthcare: Intelligent Healthcare Technology



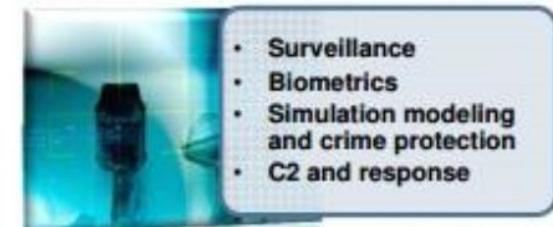
- Use of eHealth and mHealth systems
- Intelligent and connected medical devices

Smart Citizen*: Civic Digital Natives



- Use of green mobility options
- Smart lifestyle choices

Smart Security: Next Generation 911

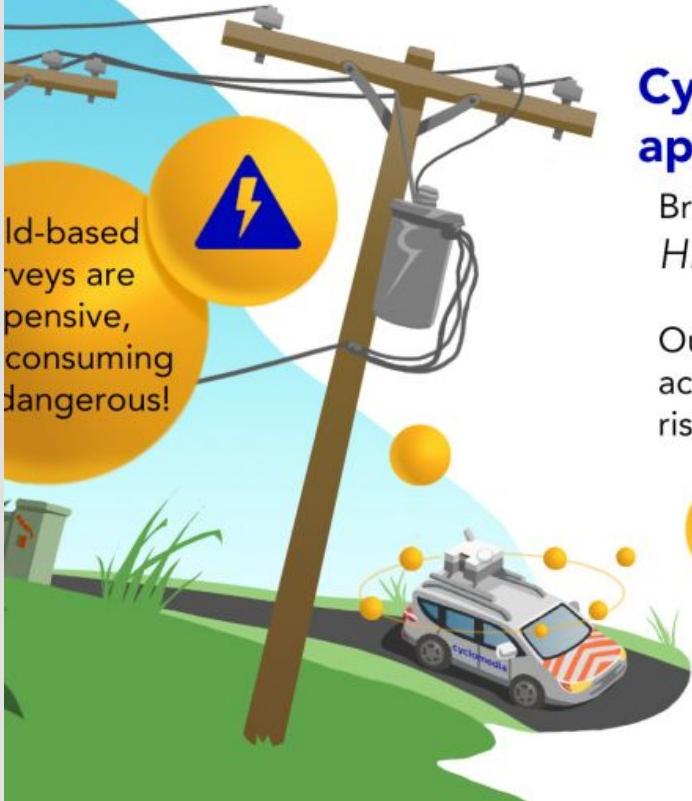


- Surveillance
- Biometrics
- Simulation modeling and crime protection
- C2 and response

*Smart citizen and smart technology are integrated and not covered separately in this analysis.
Source: Frost & Sullivan

The **cyclomedia** Solution Difference

VISUALIZE A BETTER WORLD



Cyclomedia brings a modern approach to asset management

Bring the real world to your desktop with *HD 360° Imagery and LiDAR.*

Our solution creates a high quality, accurate asset database while lowering risk with fewer resources.



Cut your project timelines and costs in

HALF

compared to traditional methods.



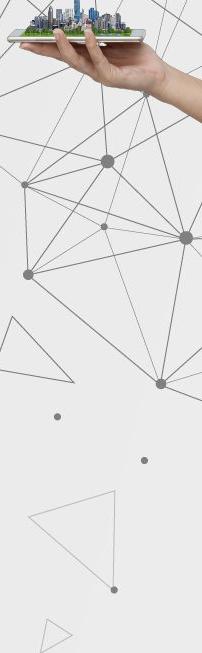
INTEGRATE WITH
Esri
Smallworld
AutoCAD



Unparalleled Data

Gain insights from attachments & surveys

Accelerate asset inspection with precise data for vegetation management, reliability, and more.



TRENDING TOPICS



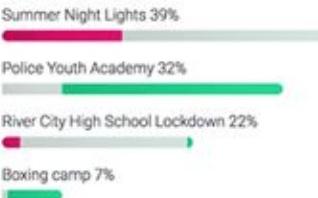
POPULAR WORDS

administration parents roads intersection transit
liberty bridge light electrical
parent flooding kids wall
traffic water administration permit asphalt
teacher vehicle road animal
rain cam uvesess say carson jet
school pothole children downtown
amazon hill rd issa
north paving fire parking issue
paving strike streets
negotiations

SENTIMENT OVERVIEW



PROJECTS

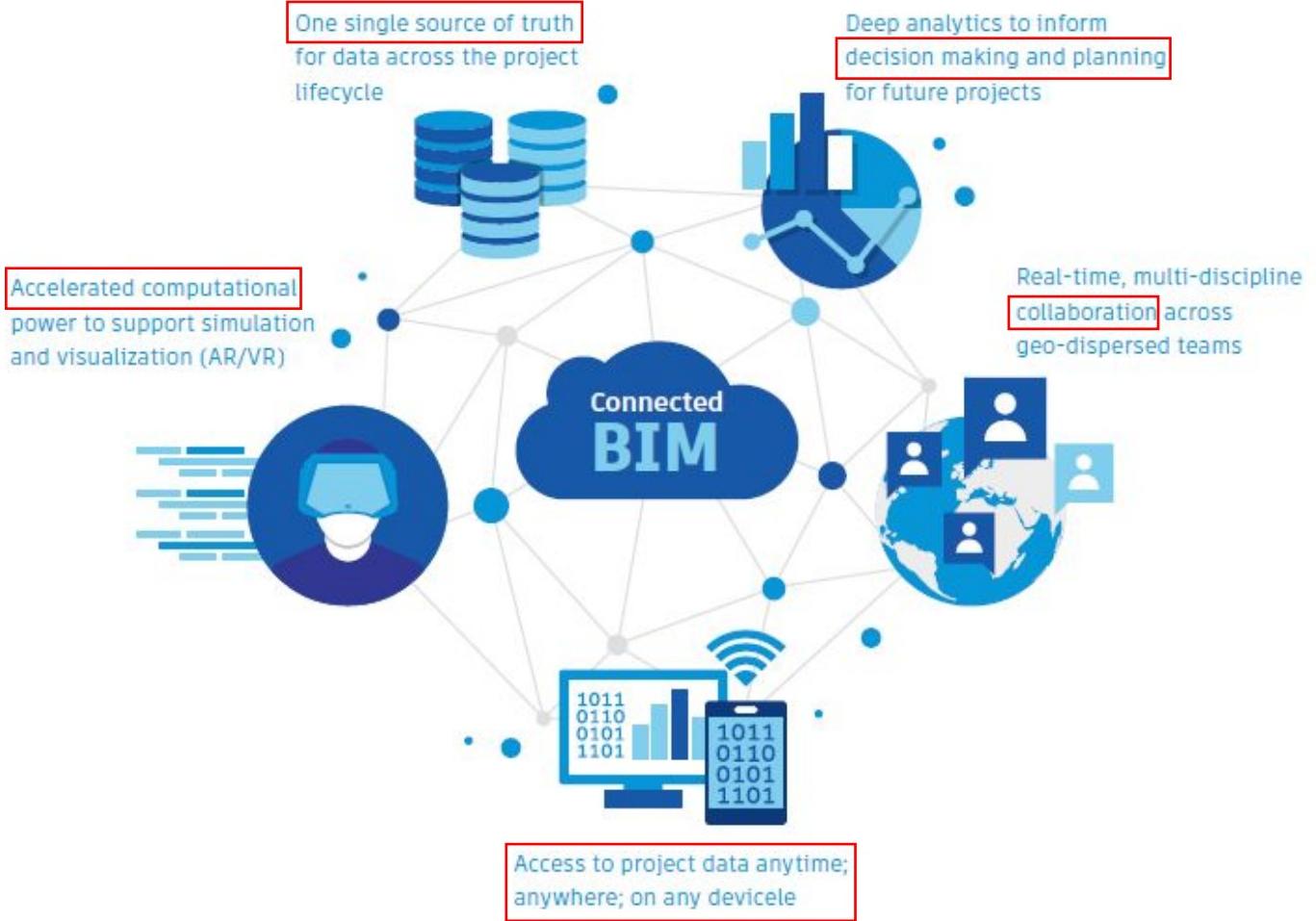


LEADING STORIES



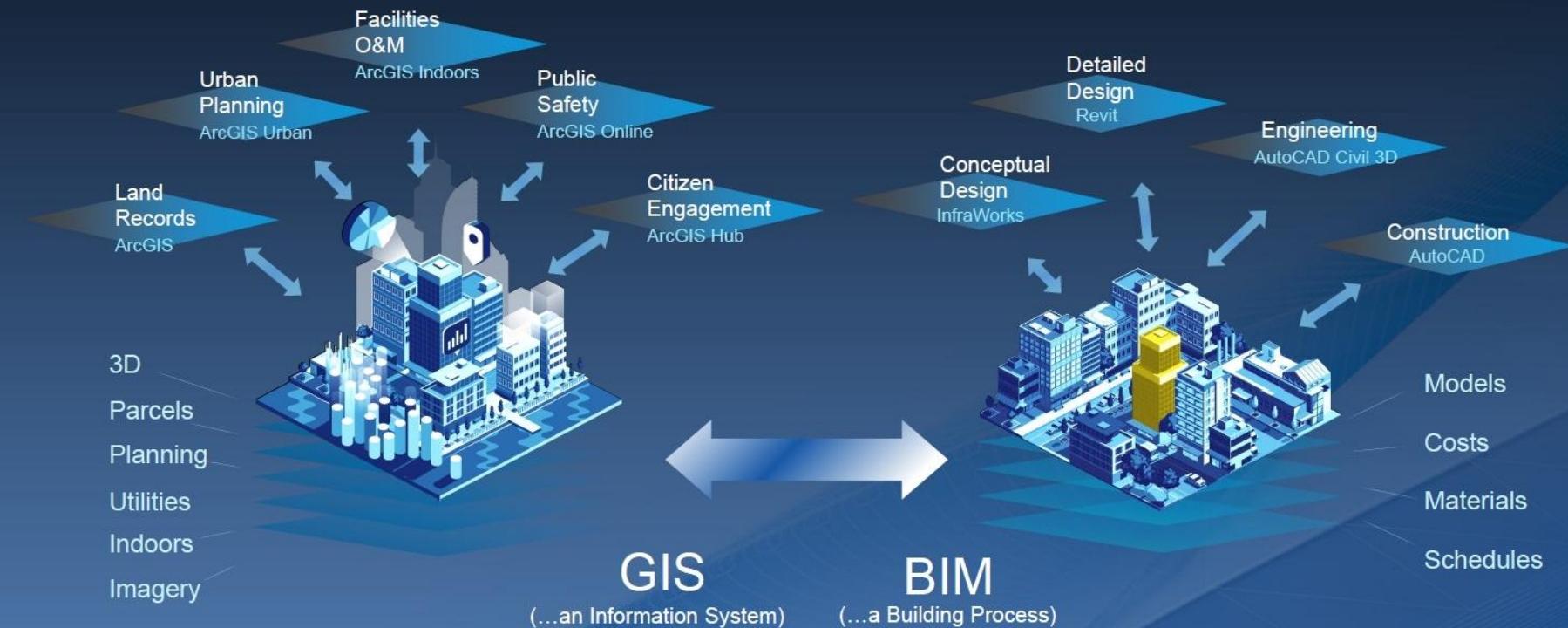
MAP

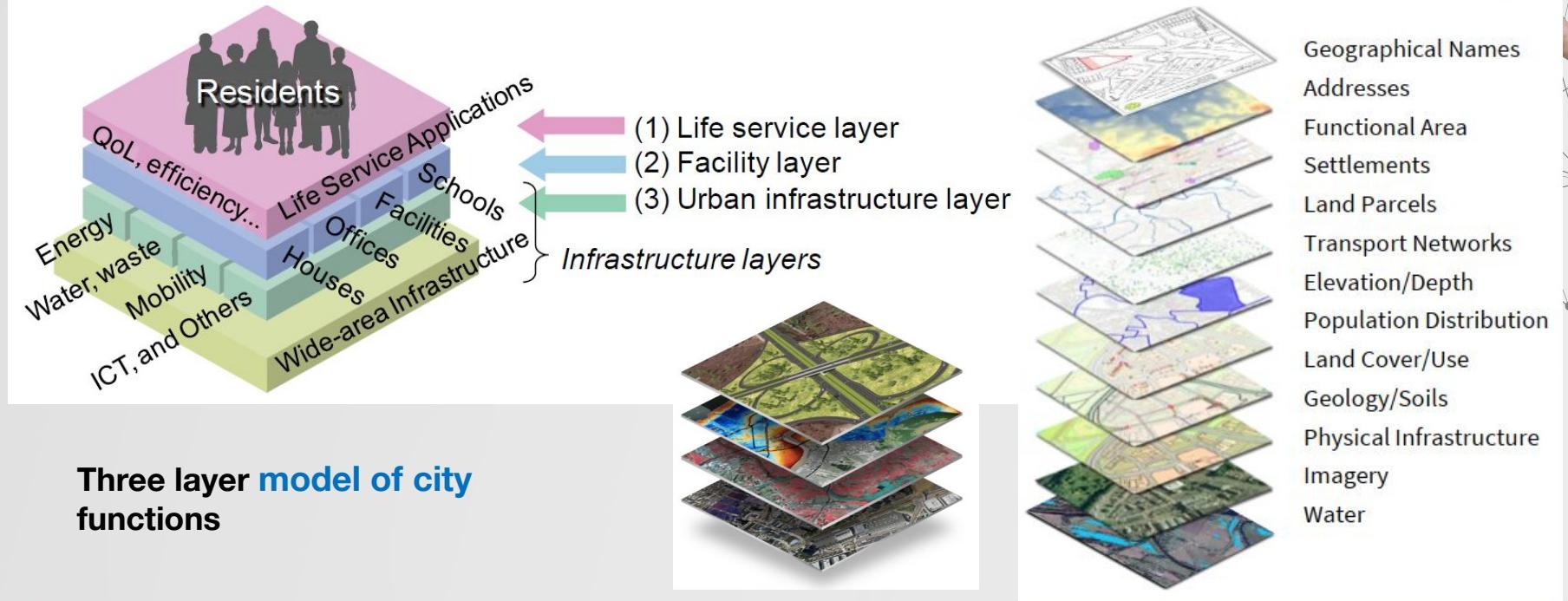




Smart Cities and Infrastructure with GIS and BIM

Technology integration leads to smarter more efficient cities





Three layer model of city functions

Citizen engagement

Issue identification and prioritisation

+

Data collection

Right data, at the right time

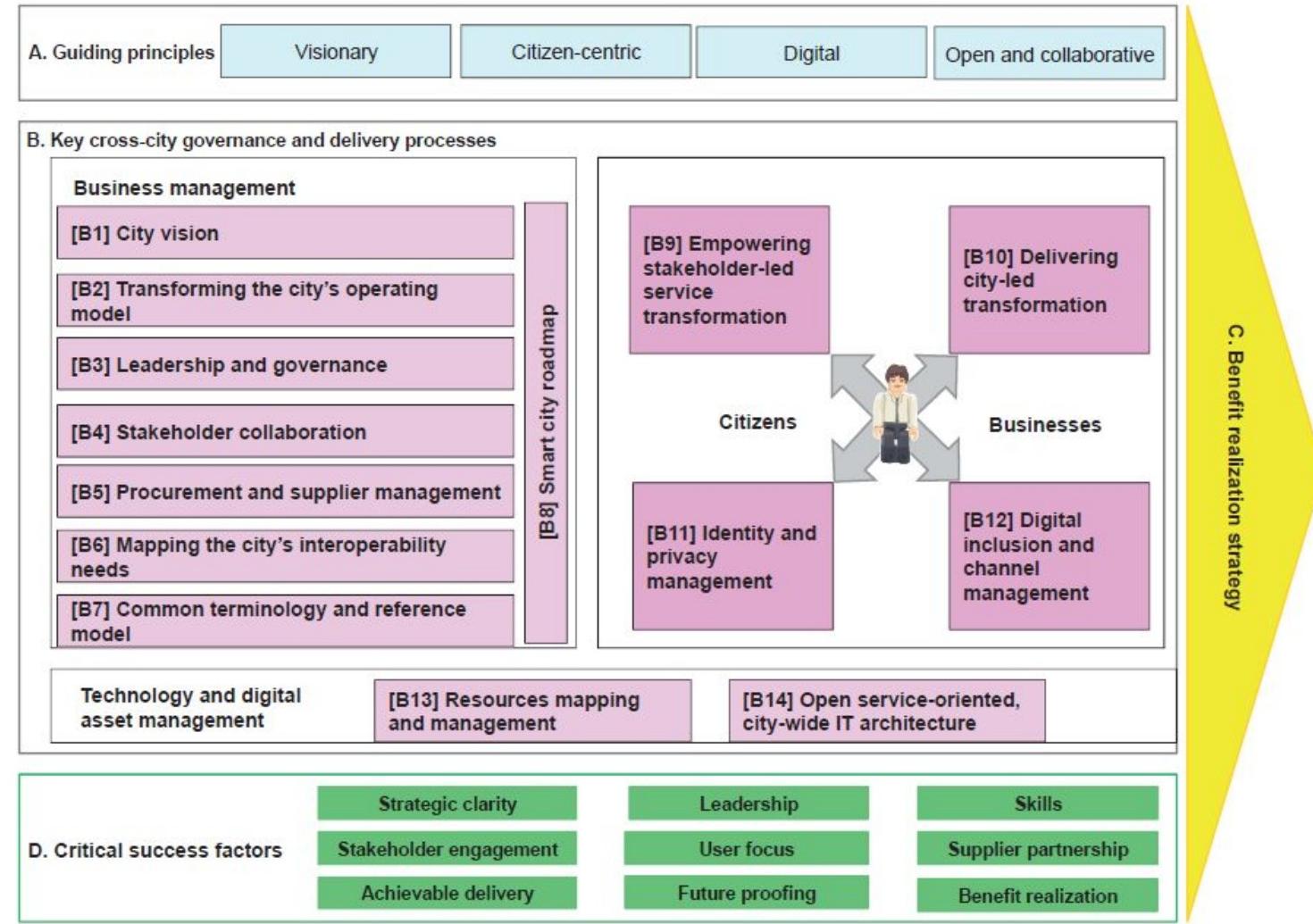
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Technology

= Optimum solutions and value

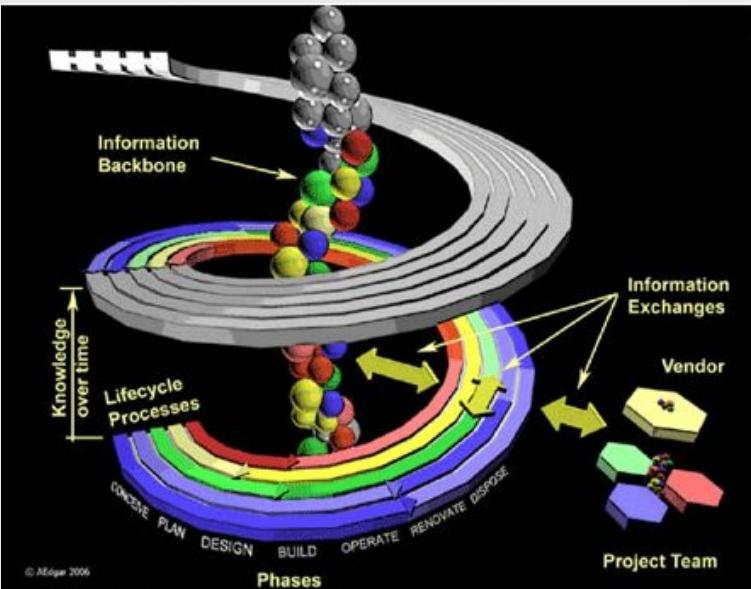
Identifying the right technology to do the job

The smart city framework

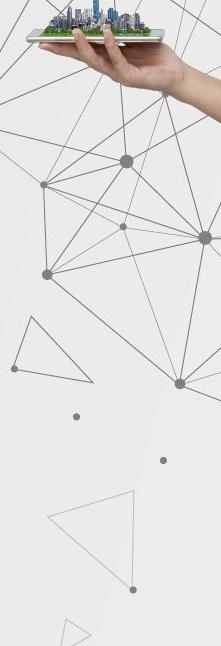


BIM and Urban Planning and Design

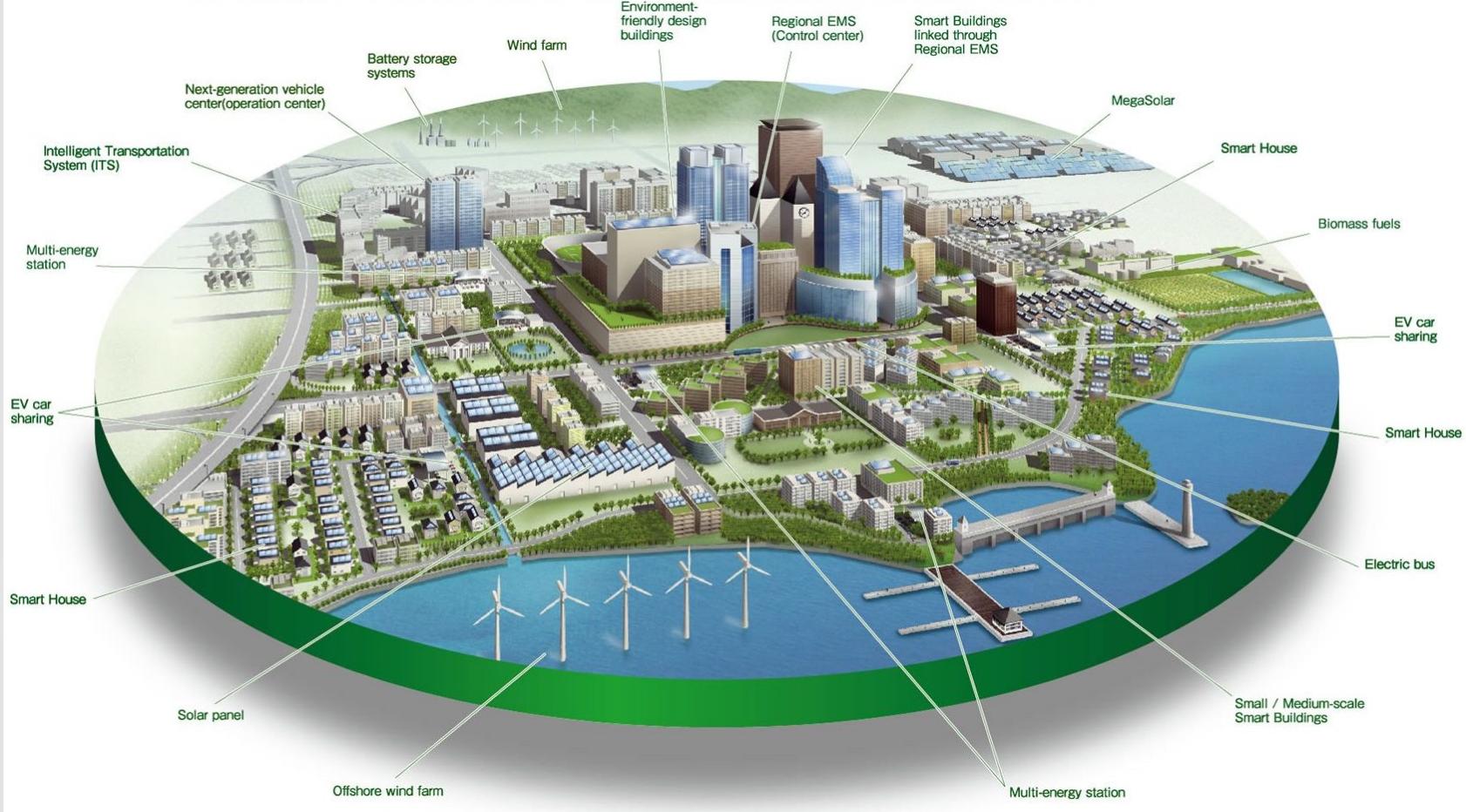
Omar Selim



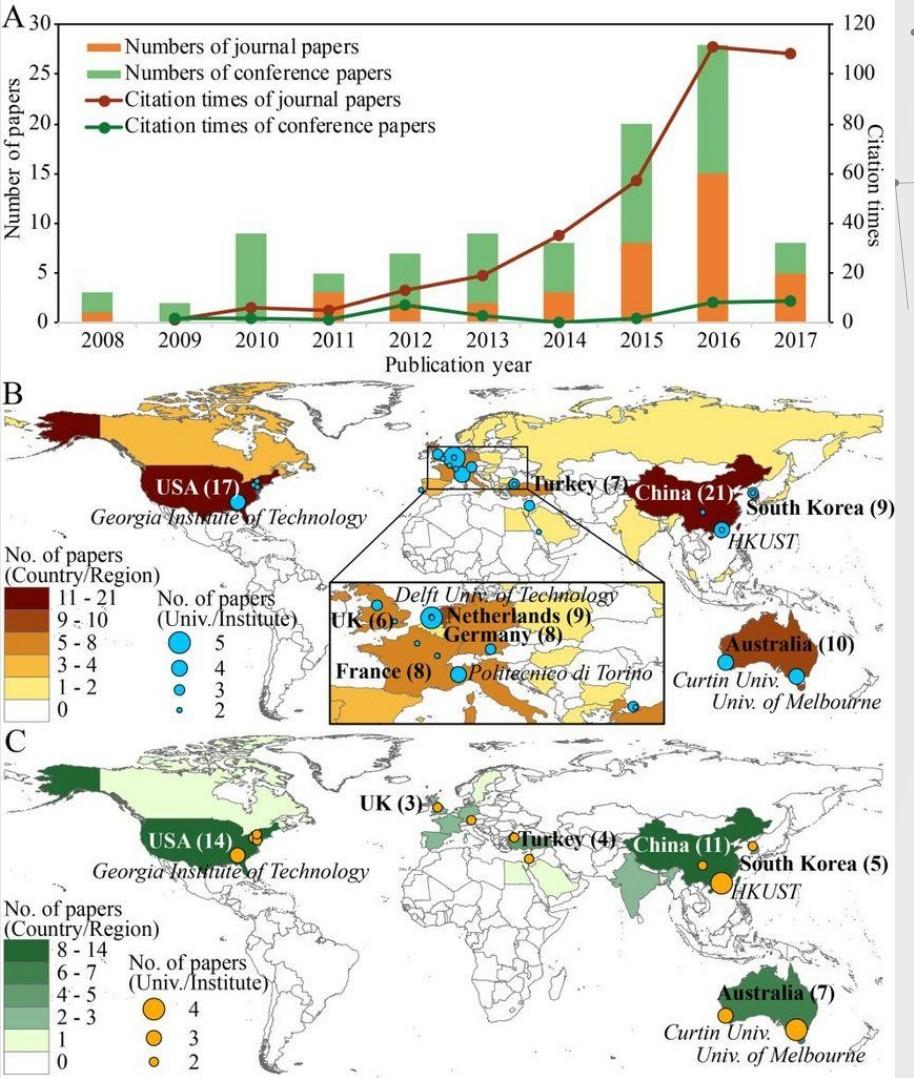




International and regional experiences in



Trends and worldwide distributions of BIM-GIS integration during the past ten years. (A) 149 Trends of publications; (B) Map of publications; and (C) Map of SCI/SSCI indexed journal papers.



A *BIM for Sustainable Cities* plan is part of a [3D digital cities](#) initiative
and depends on the convergence of CAD, GIS and BIM and the
integration of...

- Modeling and Design
- Surveying & Data Collection
- Planning, Site Selection & Conceptual Design
- Clash Detection, Simulation and Analysis
- Visualization
- Multidiscipline Coordination
- Construction & Construction Management
- Operation and Maintenance



Why use BIM?

- 3D digital representations of infrastructure
- Includes descriptive info (dimensions, materials, manufacturers, etc.)
- Aids in proper design, construction, operation, and maintenance
- Drawback: files size and complexity
make data difficult to repurpose



Why use GIS?

- Map and analyze geographic features
- Uses location and imagery
- Conveys data on a large scale
- Data models, attributes, simple geometries, and domains



CIM Utilizes Many Tools

CIM Tools

Modeling Tools

2D Digital Design Tools

3D, 4D, and nD Modeling Tools

Traffic Modeling and Simulation Tools

Data Management Tools

Project Information Management Systems

Asset Information Management Systems

Geographical Information Systems (GIS)

Digital Signatures

Mobile Digital Devices

Sensing Tools

Airborne, Mobile, and Terrestrial LiDAR

Aerial Imagery (satellites)

Global Positioning Systems (GPS)

Robotic Total Stations (RTS)

Ground Penetrating Radar (GPR)

Radio Frequency Identification (RFID)

Real time Network

Integrated Measurement Systems

Drones/Unmanned Aerial Vehicles (UAVs)



CIM core blocks



CIM Tool



CIM Tools – Modeling

- Create virtual/digital representations of project data



2D Digital Design Tools

- Tools that agencies use for design data exchange and organization
- Some examples include plans, specifications, and 2D CAD files



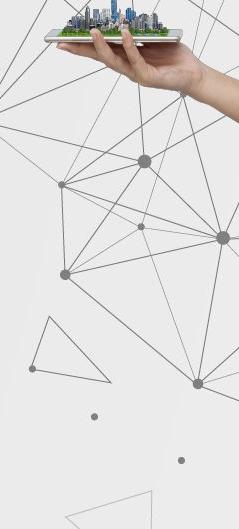
3D, 4D, and nD Modeling Tools

- Tools to create 3D/4D/5D models for design and visualization.
- Resolving spatial conflicts among design entities (e.g. utility conflicts) and construction activities (temporal conflicts)



Traffic Modeling and Simulation Tools

- Tools used to conduct studies through simulation at macroscopic (state or regional) or microscopic (roadway) level
- Used for Impact studies (e.g. traffic delays) and aids public information when combined with design visualization



CIM Tools – Data Management

- Software to manage project information throughout design, construction, and maintenance lifecycle



Project Information Management Systems

- Manages & allows sharing of documents, databases, model-based data during project delivery processes
- Includes document management systems for contract administration, daily work monitoring, and overall project management



Asset Information Management Systems

- Used for archiving asset data after construction and supports inventory asset management during O&M lifecycle
- Also assists future project development.



Geographical Information Systems (GIS)

- Associates databases with geospatial positioning information
- Offers benefits for planning and programming, environmental assessment, surveying, and asset management



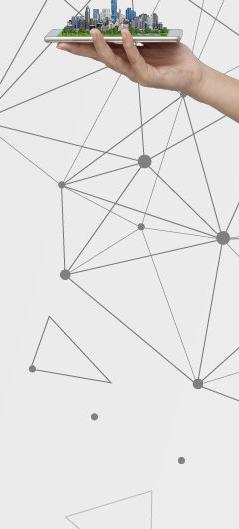
Digital Signatures

- Electronic signatures secured with encryption technology
- Eliminates need to print, sign, and scan and allow continuous flow of digital documents



Mobile Digital Devices

- Allows field access of digital documents
- Eliminates need to carry all the paper copies of plans, Specifications, Standards required for inspectors of multiple projects



CIM Tools – Sensing

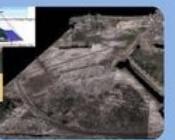
- Advanced Surveying tools improve coverage, speed, data accuracy, and can reduce costs.



Airborne, Mobile, and Terrestrial LiDAR

Laser scanning and measurement in three different configurations (static, mobile and airborne)

Uses: Accurate and dense point cloud data for design, quantity estimates, and 3D Models



Aerial Imagery

- Overlaps two grayscale photos taken from aircraft to provide 3D data
- Design and computation of earthwork, mapping, photogrammetry



Global Positioning System (GPS)

- 3D spatial coordinate data used for design & construction
- Mapping, surveying, Automated Machine Guidance.

CIM Tools – Sensing (cont'd.)



Robotic Total Stations (RTS)

- Remote-controllable Total Stations from observation point (one-operator)
- Greater accuracy of measurements, used for AMG (final earthwork, paving, etc.)



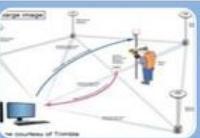
Ground Penetrating Radar (GPR)

- Subsurface mapping using radio waves.
- Locate underground utilities, groundwater, tunnels, and other objects



Radio Frequency Identification (RFID)

- Tags/chips emit radio waves for tracking
- Track materials, equipment, utilities, etc.



Real Time Network (RTN)

- Continually Operating Reference Stations (CORS) for real-time positioning
- Surveying, AMG, QA/QC checks



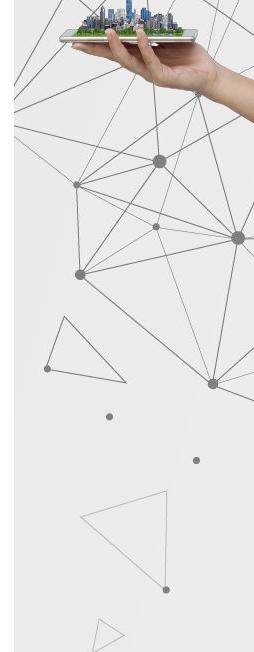
Integrated Measurement System (IMS)

- Feedback control system with sensors and GPS for temperature control
- Used for Intelligent Compaction (IC)



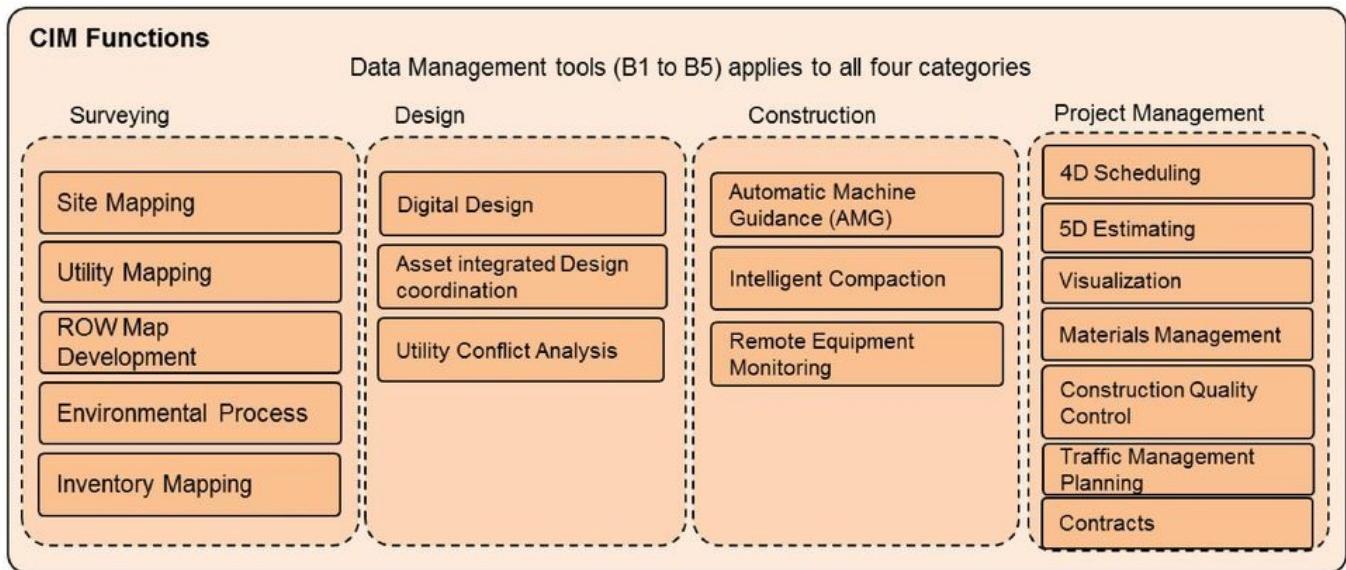
Unmanned Aerial Vehicles (UAVs)

- Drones collect geo-referenced images and point clouds for surveying and quality control
- Rapid data collection, high precision, image resolution





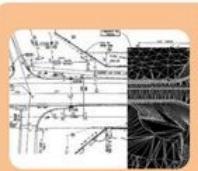
CIM Tools Affect Many Functions



Each CIM tool improves the performance, predictability or transparency in executing one or more CIM functions.

CIM Functions – Surveying

- CIM functions primarily related to *data collection and measurement* tasks for project development and asset management



Site Mapping

- Advanced surveying tools (LiDAR, drones, RTN for geospatial data collection)
- Expedite project development, tracking work progress, creating as-built records



Utility Mapping

- Utilizing tools such as RFID, GPR, and GPS to locate and store utilities data
- Resolve utility conflicts preconstruction and utility coordination process



ROW Map Development

- GIS and asset information systems to digitally record and manage files and plans



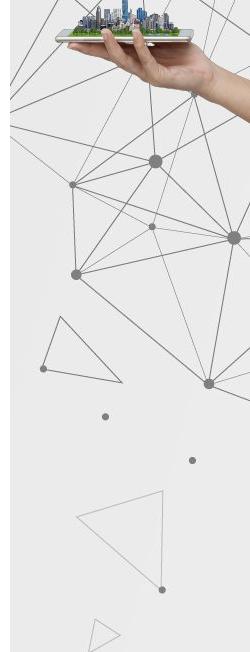
Environmental Process

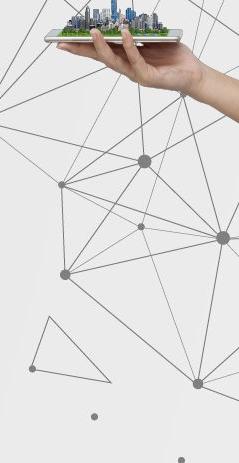
- GIS to expedite the impact assessment, enhance quality and credibility of data



Inventory Mapping

- GIS, GPS, and LiDAR to map and store assets in a more efficient way
- Track maintenance data of assets, digital records of existing assets





CIM Functions - Design

- Functions performing *design* or *design-related* tasks in project delivery process



Digital design

- 2D digital design tools and nD modeling tools
- Creation of digital models of terrain, project elements



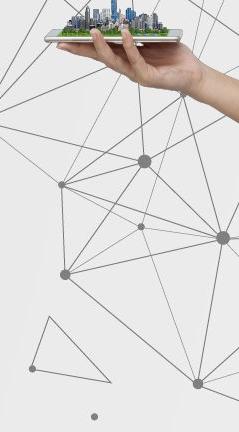
Design Coordination and Asset data integration

- Using nD models for design and constructability reviews
- Integrating asset identification, attribute data for asset management



Utility Conflict Analysis

- 2D, 3D, nD modeling, and clash detection tools to detect conflicts
- Reduce Requests for Information (RFI), change orders, and claims.



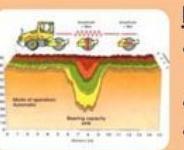
CIM Functions – Construction

- Functions directly related to *construction* of a project



Automated Machine Guidance (AMG)

- 3D terrain models and GPS/RTS automate construction operations (excavation, grading, asphalt/concrete paving)
- Increases productivity and safety on-site, reduces rework, and helps in QA/QC checks



Intelligent Compaction (IC)

- GPS and IMS to promote efficient compaction of soils and pavements
- Improves quality of pavements
- May result in time/cost savings



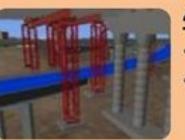
Remote Equipment Monitoring

- Also known as Equipment Telematics
- Uses GPS/RTN connectivity to remotely monitor and control equipment operations
- Reduces idle time, increases utilization rate, optimizes labor productivity

CIM Functions

– Project Management

- Other functions for *monitoring, controlling and managing projects*



4D Scheduling and 5D estimating

- Adds time (4D) and cost (5D) data to the 3D model
- Assists constructability analysis, scheduling, verifying payments, and estimating



Visualization

- GIS and nD modeling tools to enhance physical, geospatial or functional details of the model
- Communication and public information activities



Traffic Management Planning

- nD modeling and traffic simulation tools for preparation of traffic control plans



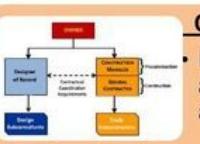
Construction Quality Control

- Mobile digital devices, RTN and Rover-based QA/QC checks
- Frequent and accurate creation of as-built records and good communication



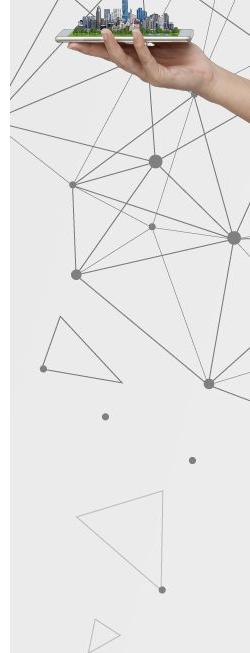
Materials Management

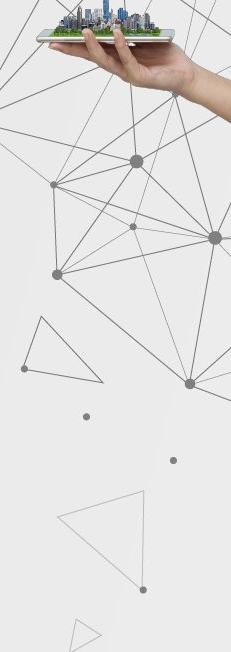
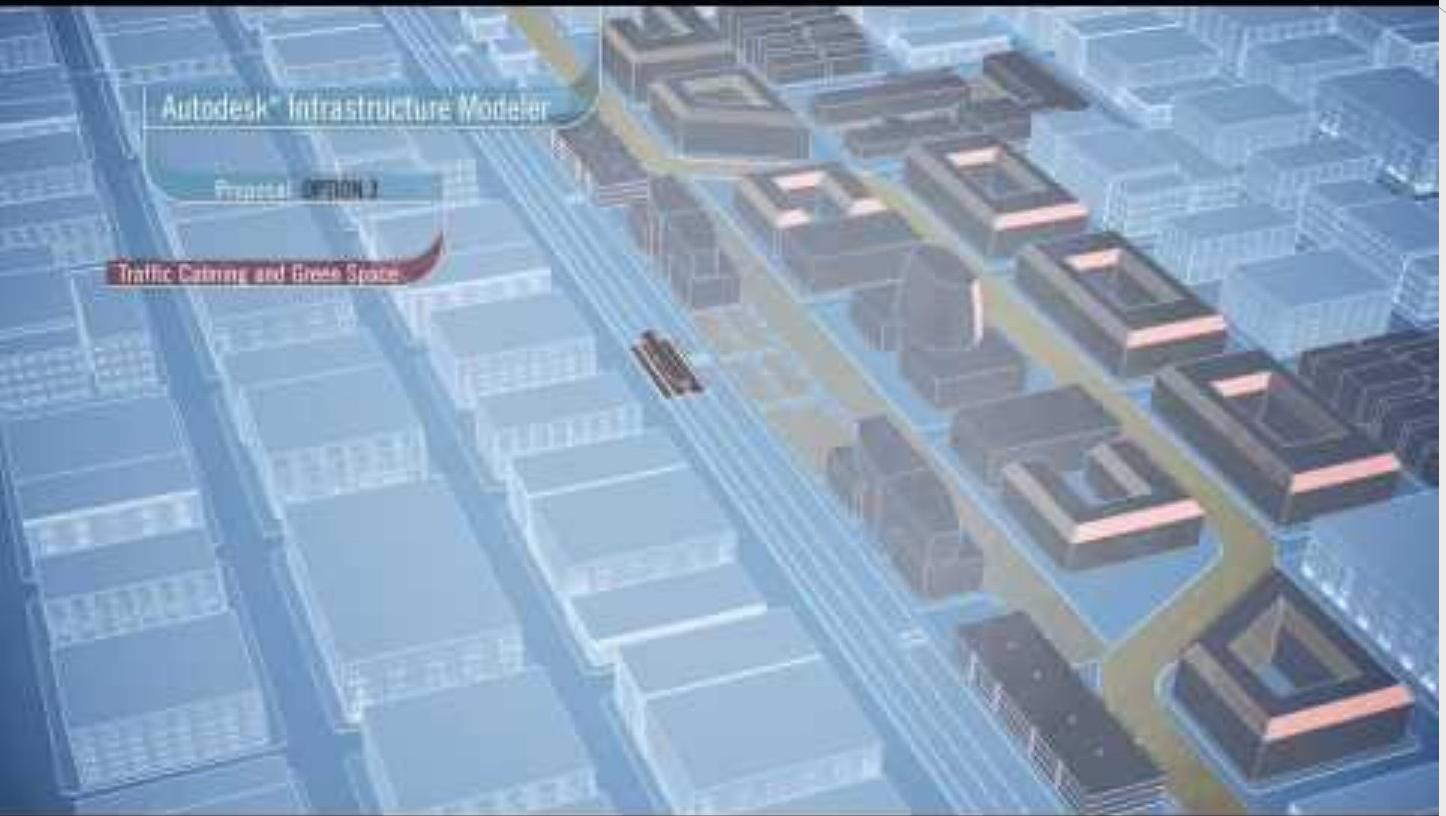
- RFID and GPS technologies to manage materials on supply chain and on-site



Contracts

- Information management systems for contract administration and management (e.g. bid letting, RFIs, shop drawing reviews and approvals, submittals and correspondences)







A futuristic digital interface for stormwater management optimization. The background shows a 3D rendering of a landscape with green trees and blue water, with several black curved lines representing drainage or water flow paths. A white beam of light originates from the center and points towards the bottom left.

STORMWATER MANAGEMENT OPTIMIZED

CONSTRUCTION PHASE

CONSTRUCTION SCHEDULE MANAGEMENT

75°F 4/12/14 11:38 AM

DATASET 1	DATASET 2	DATASET 3

03.27.2015 ►

SEARCH | PREVIOUS RECORDS | DOWNLOAD | PRINT | DOWNLOAD AS PDF | DOWNLOAD AS IMAGE | DOWNLOAD AS SPREADSHEET | DOWNLOAD AS XML | DOWNLOAD AS JSON | DOWNLOAD AS CSV

What makes a city smarter?

A smart city should monitor and integrate conditions of all of its critical infrastructures, from roads and bridges to major buildings

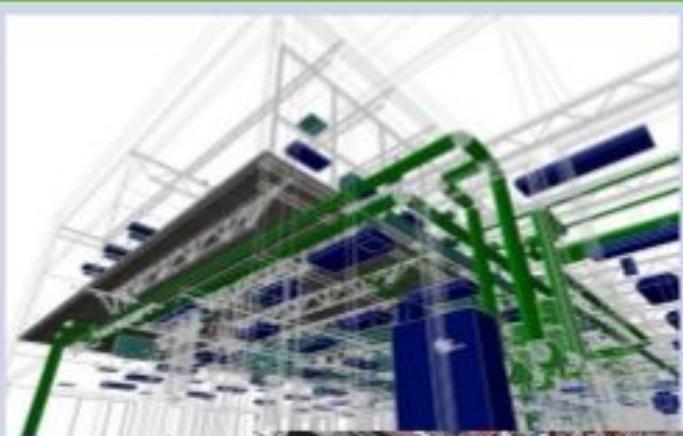
- to better optimize its resources
- plan its preventive maintenance activities and
- monitor security aspects
- Smart cities are a move from data silos to data sharing by creating a common object model
- By data sharing it can meet the needs of the many, whether utilities, transport providers, public health, emergency services, asset managers, urban planners, businesses and citizens

◦ and... **TECHNOLOGY Makes It Happen**

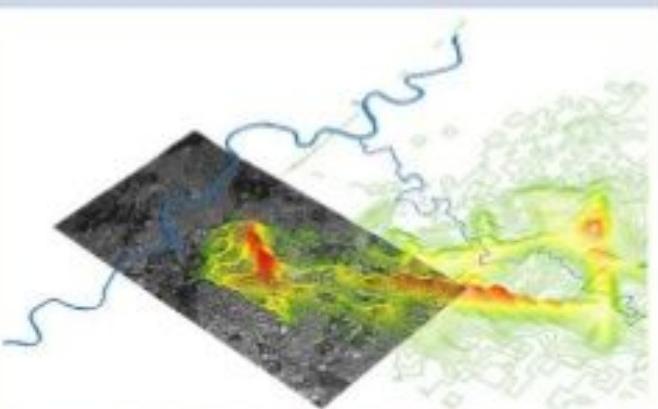


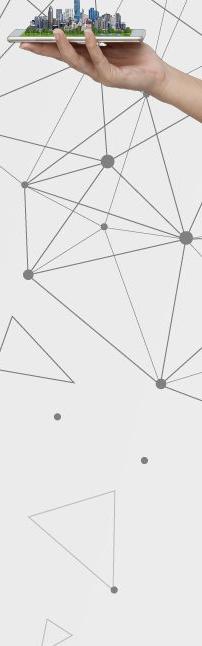
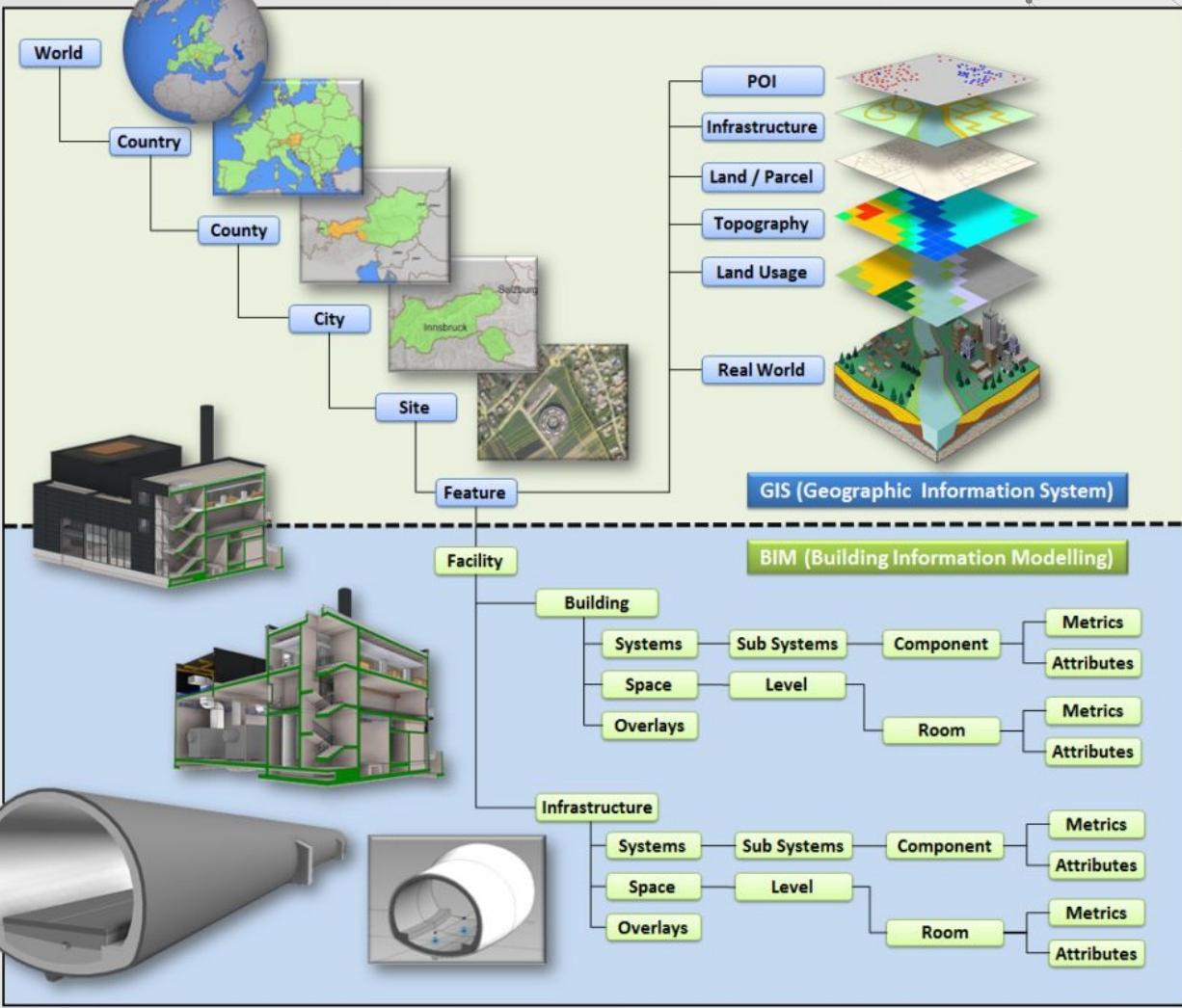
- BIM data and GIS data are xenogeneic data.

BIM data

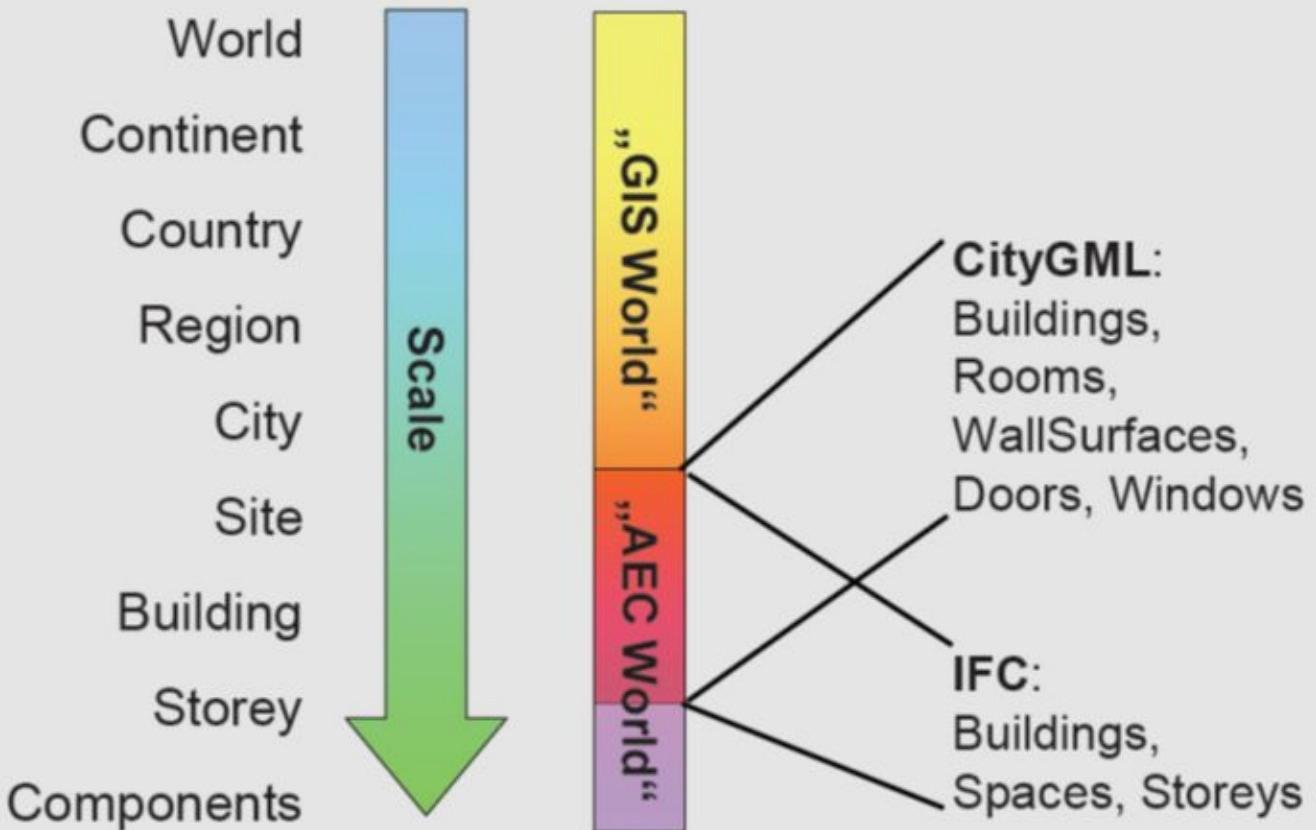


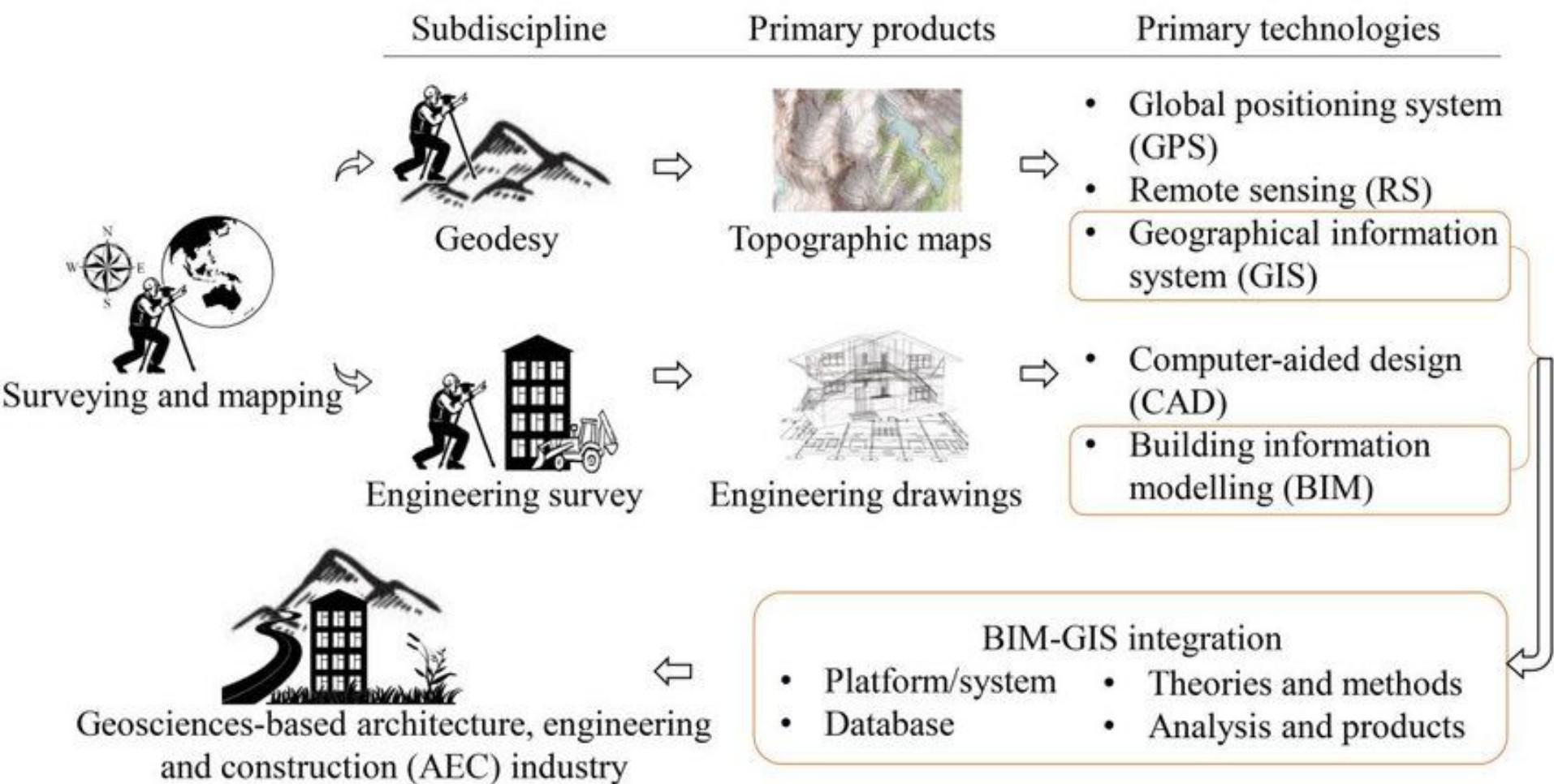
GIS data





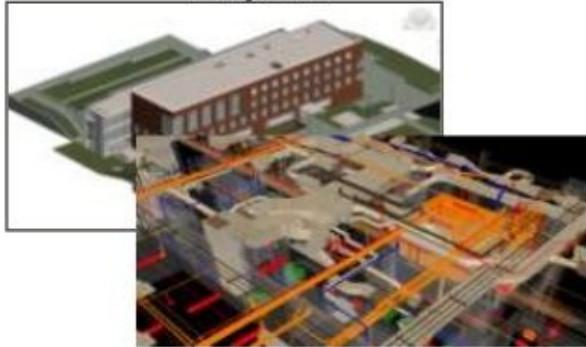
CityGML and BIM / IFC





History of BIM-GIS integration from the perspective of surveying and mapping

Projects



Data
Updates

FM Systems

Security
CMMS

Life Safety

Space Inventory

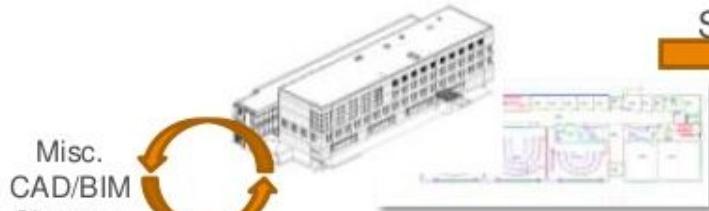
Room Scheduling

Record Documents

EH&S

Geometry
Update

CAD/BIM



Automated
Sync

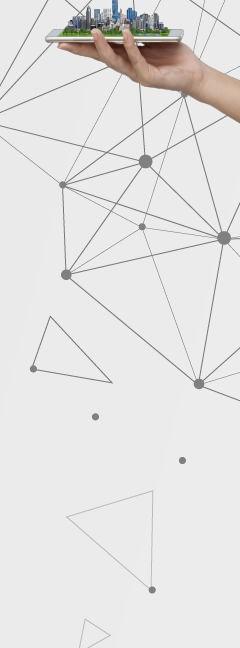
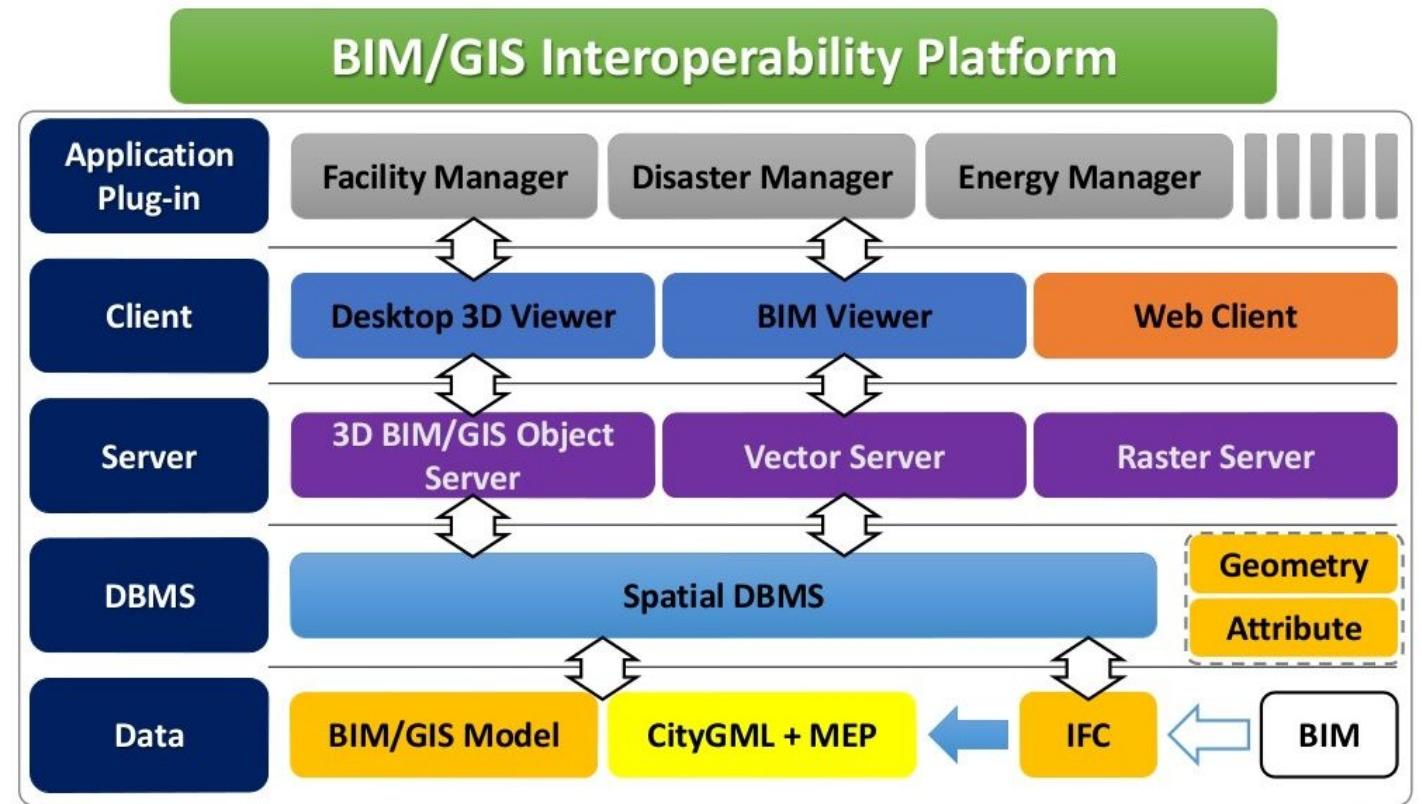


Misc.
CAD/BIM
Changes

Misc.
GIS
Changes

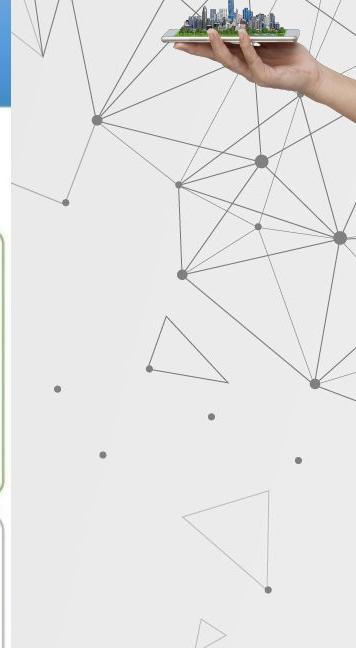
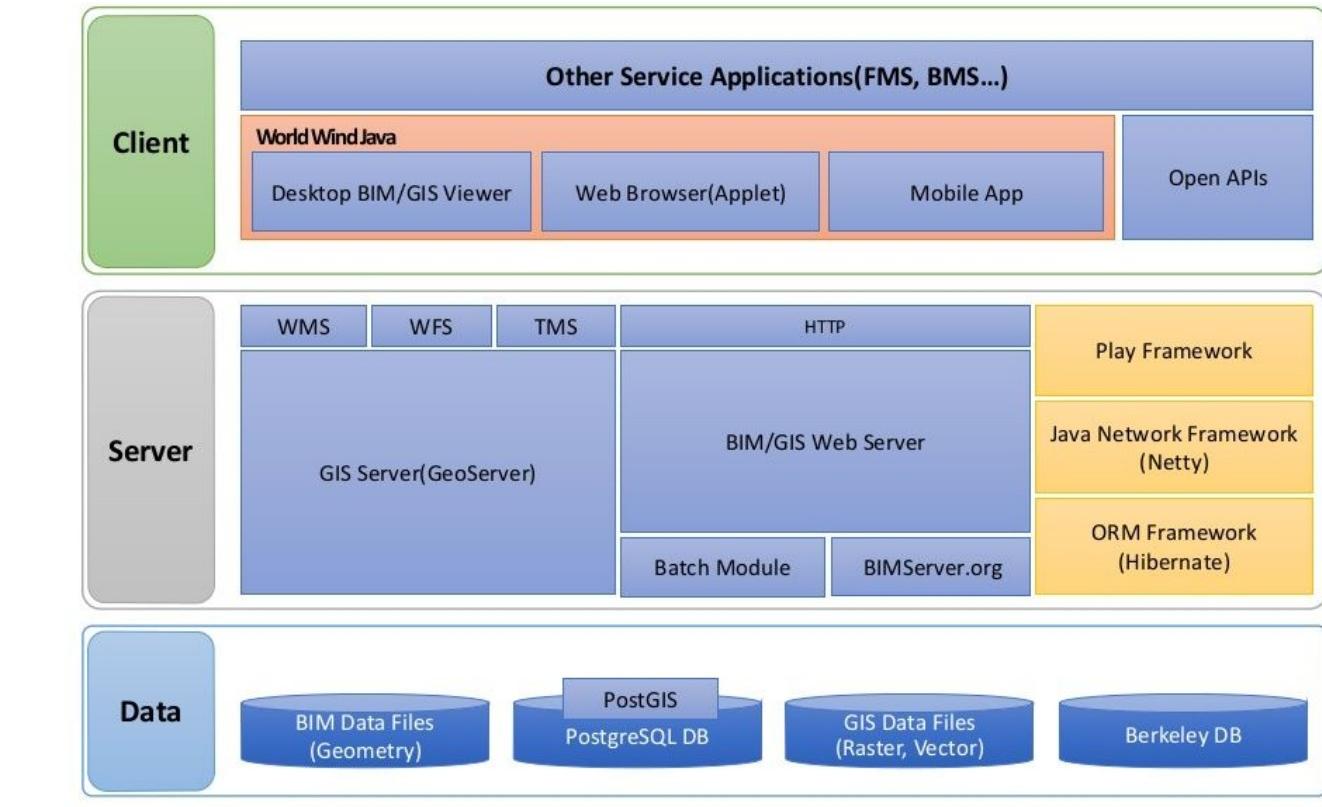
System Architecture for BIM/GIS Interoperability Platform

- For interoperable BIM on GIS platform, complicated system is required.



Platform Architecture

- Target platform should provide accessibility, interoperability, scalability, and compatibility.



Client Development

- Our target is to integrate BIM data into 3D GIS data.

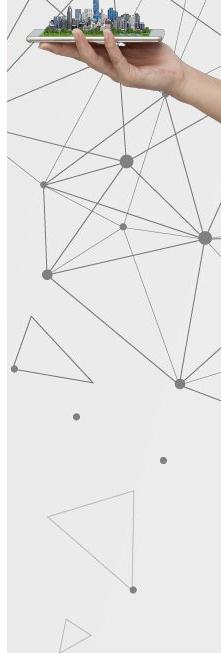
The diagram illustrates the integration of Building Information Modeling (BIM) and 3D Geographic Information Systems (GIS) data. It consists of three main components:

- 3D GIS**: A window showing a 3D globe of the Earth, representing geographical data.
- BIM Viewer**: A window showing a detailed 3D model of a building's internal structure, including floors, rooms, and structural elements.
- 3D GIS + BIM**: A window showing a combined 3D view where the building model from the BIM viewer is integrated into the 3D GIS environment, allowing for a seamless connection between indoor and outdoor spaces.

A yellow arrow points from the BIM viewer window towards the '3D GIS + BIM' window, indicating the flow of data integration.

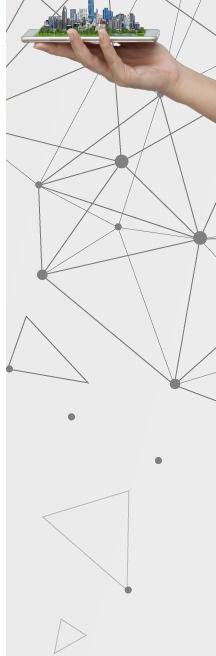
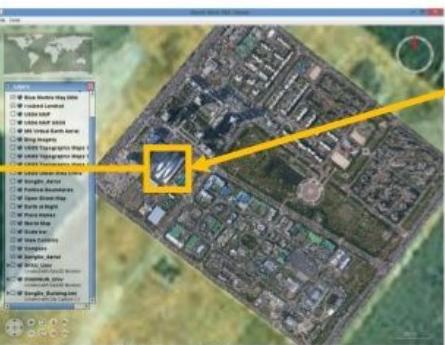
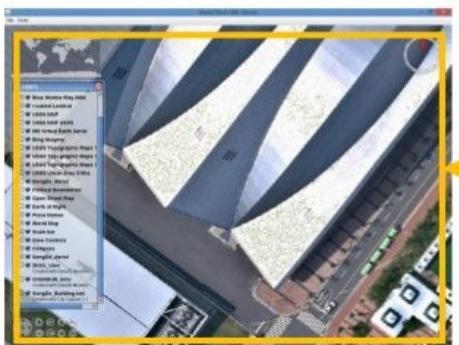
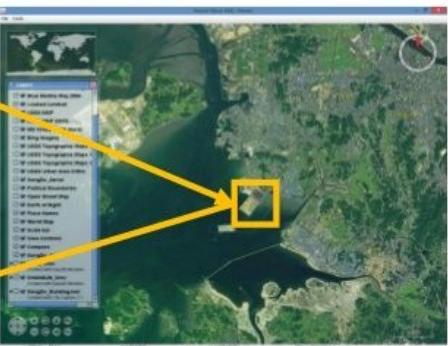
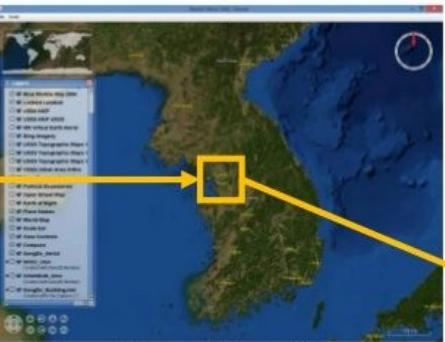
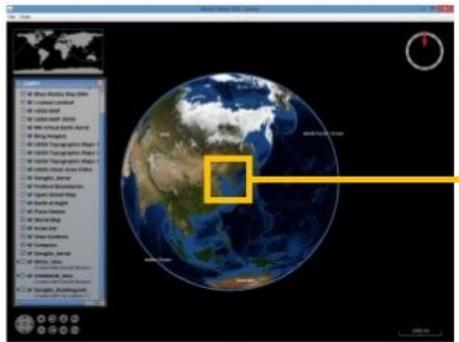
World Wind Java for 3D GIS

- World Wind is an open-source (released under the NOSA license) virtual globe developed by NASA and the open source community for use on personal computers.
- Old versions relied on .NET Framework, which only ran primarily on Microsoft Windows. The more recent Java version, World Wind Java, is cross platform.
- World Wind Java is a Software Development Kit (SDK) which is aimed at developers and is not a standalone virtual globe application in the style of Google Earth



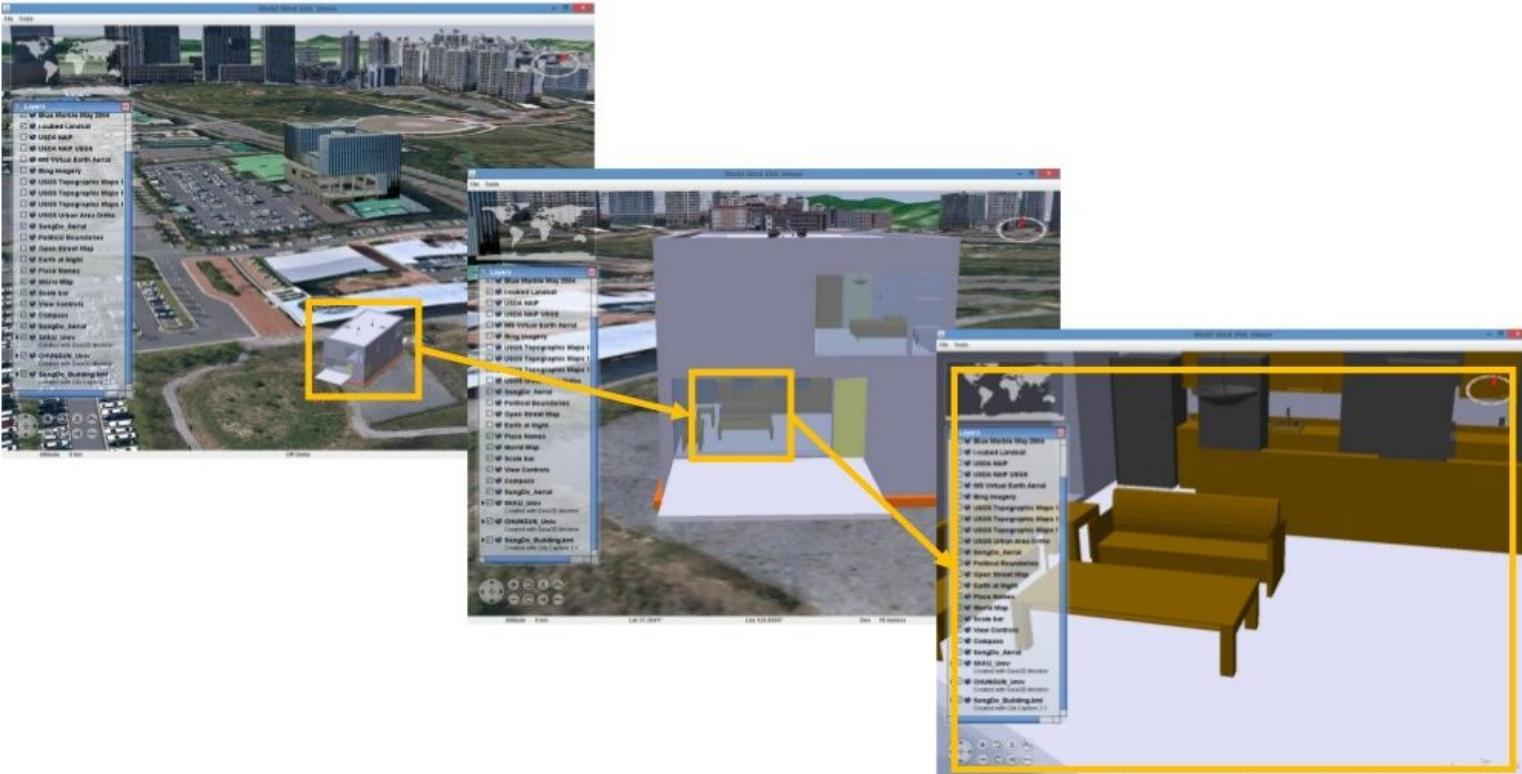
Client Development

- Providing satellite image/aerial photo service using WMS (Web Map Service) from GIS server
- NASA Blue Marble Imagery, I-cubed Landsat Imagery, Aerial Photo(12cm Spatial Resolution)



Client Development

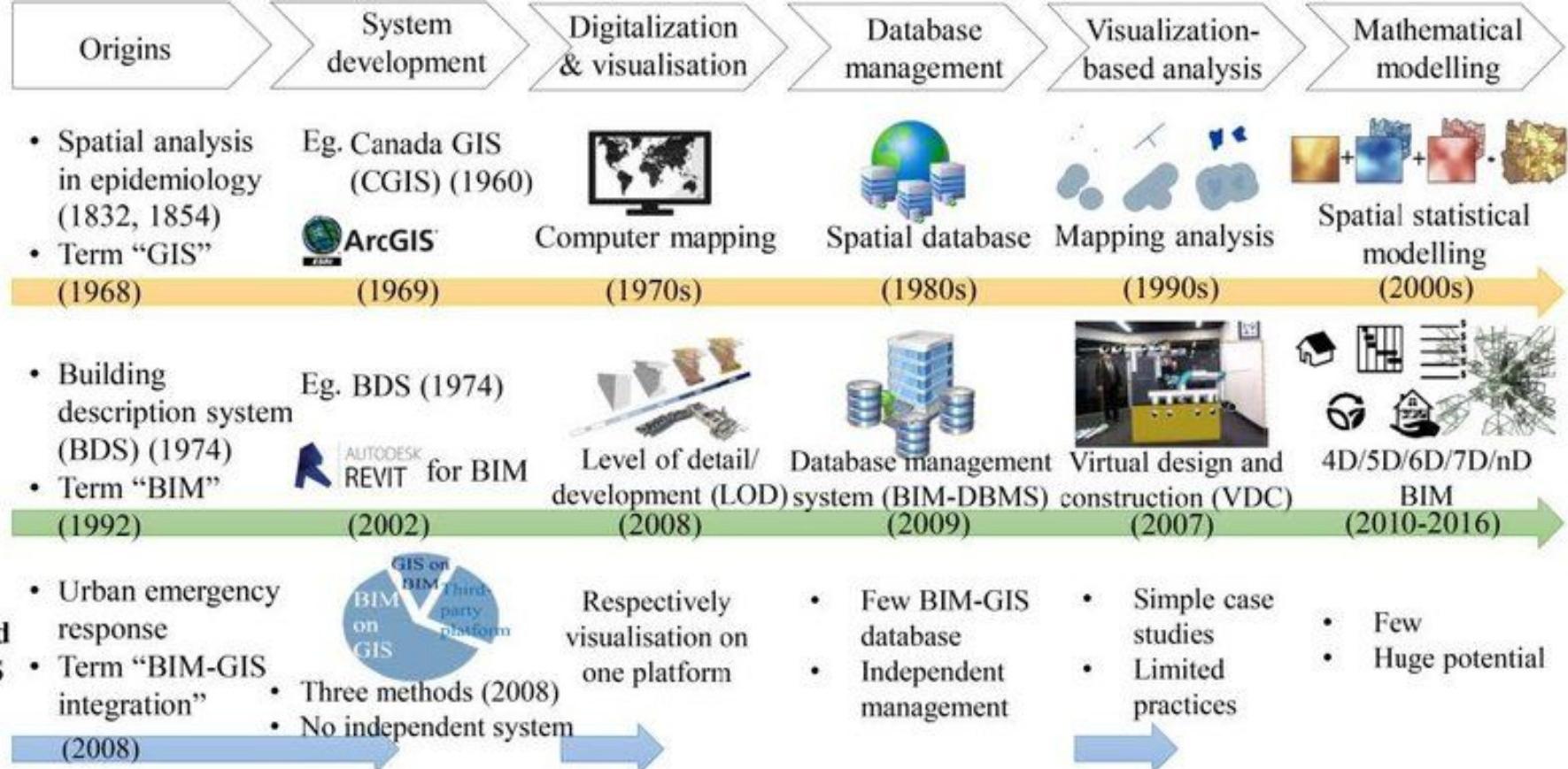
- Displaying inside and outside of building via BIM/GIS interoperability service
- Displaying BIM data with relative coordinate on absolute coordinate based WWJ based on georeference information of spatial data link model(G3D)



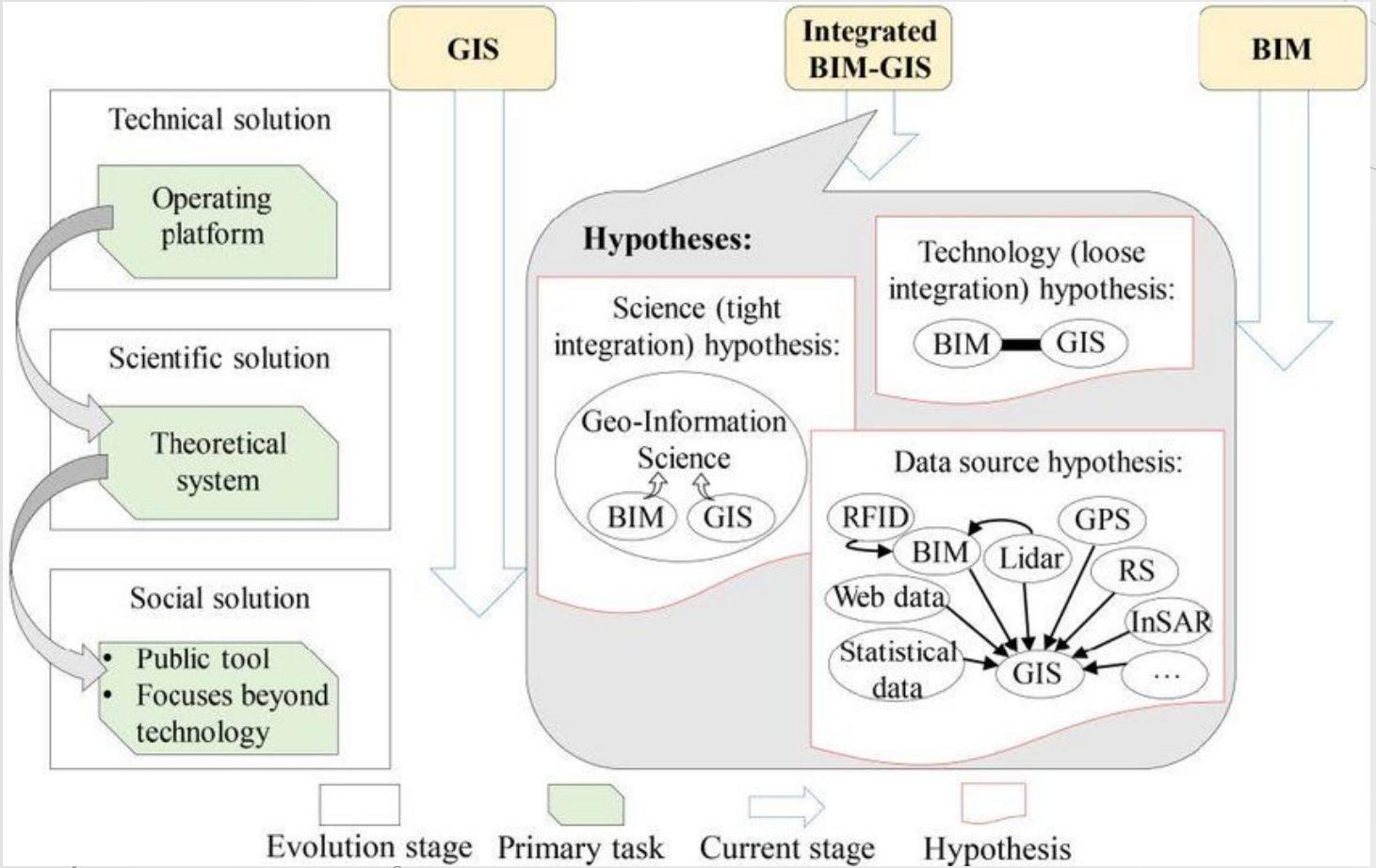
Client Development

- BIM data(IFC) visualization – Visualizing inside and outside building

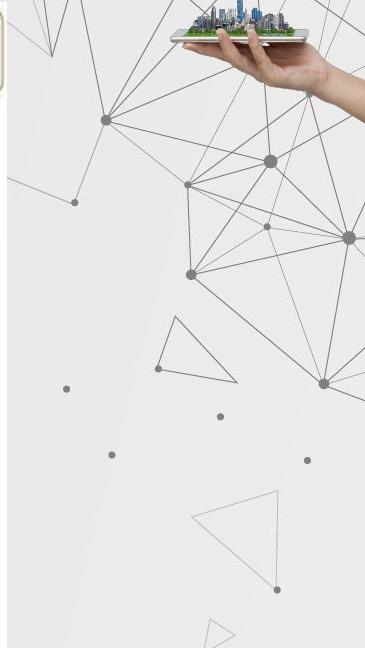




Comparison of evolution progresses of GIS, BIM and integrated BIM-GIS



Hypotheses of future development of BIM-GIS integration



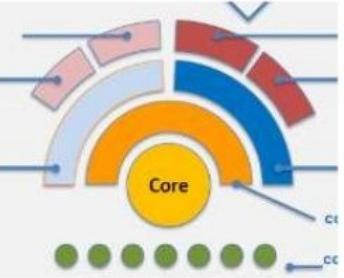
CityGML – the basics

- Application independent topographic information model for virtual 3D city models
- Basic set of features defined
- Standardised meaning/interpretation of feature types (UML/GML)
- Comprises different themes – buildings, relief, water body, vegetation, landuse, appearance, city furniture, generic objects etc
- Data model (UML) ISO 191xx standard family
- Exchange format
- Realised as a GML3 application schema
- Applications – city planning, architectural design, environmental, telecoms, disaster management, estate management, etc
 - August 2008 – cityGML version 1.0.0 accepted as an official OGC standard





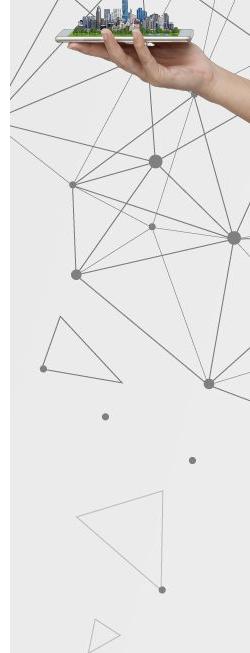
BIM



INFRA



GIS



EXPRESS &
IFC/SPFF



ifcOWL & ifcRDF

EXPRESS &
IFC/SPFF



ifcOWL & ifcRDF

XML and RDF

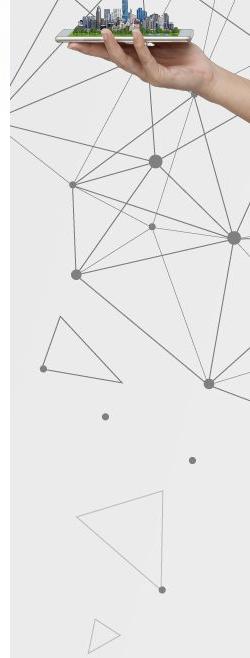
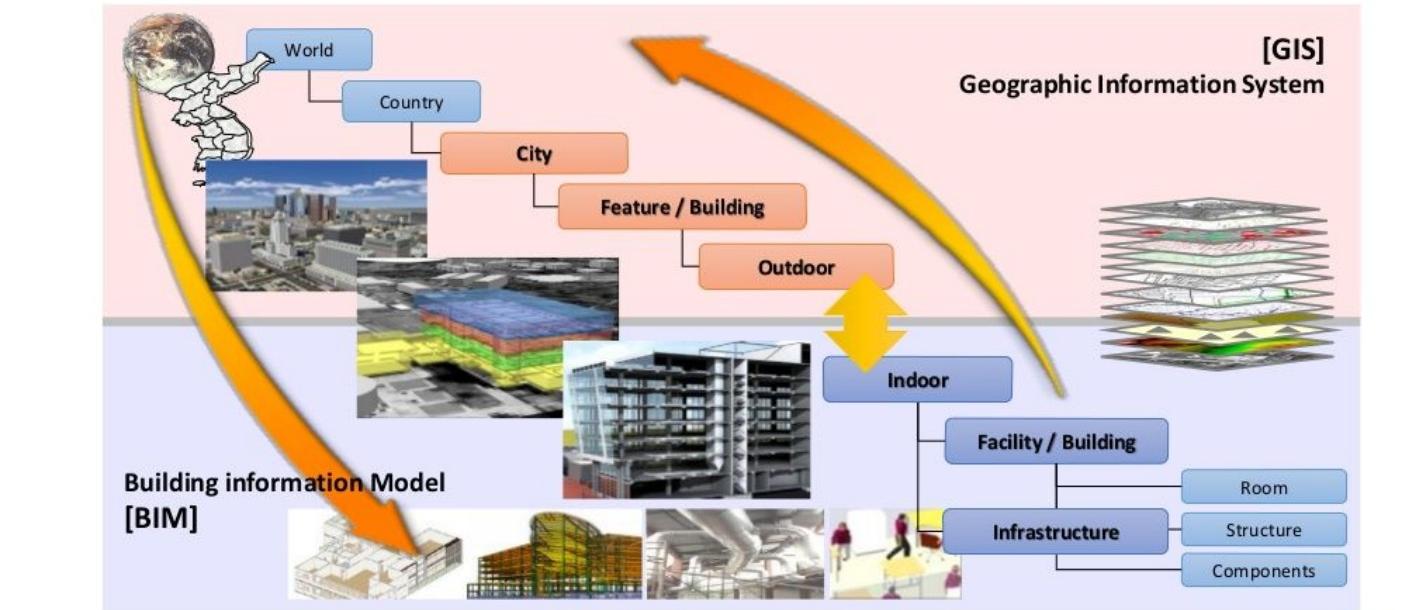


SOURCE: P. Pauwels & W. Terkaj. EXPRESS to OWL for construction industry: Towards a recommendable and usable ifcOWL ontology. Automation in Construction 63, pp. 100-133.

Building SMART International Working Group: http://building-smart.org/standards/SMART_ifc/

BIM on GIS project

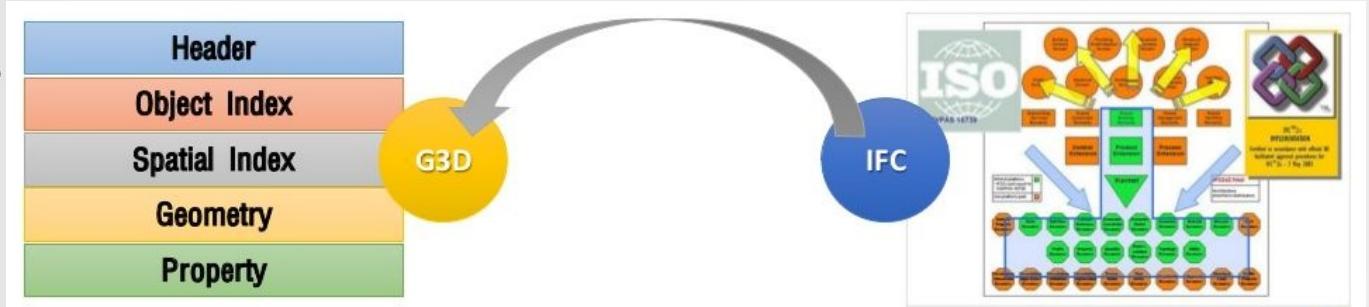
- Data model to integrate BIM data with GIS data to seamlessly and freely connect indoor to outdoor
- BIM and GIS interoperability platform for various applications and services
- Collaborative research project of Korea Institute of Construction Technology(KICT) and Gaia3D, Inc.,



Service Model of IFC for Interoperability

- Service Model: IFC conversion format for BIM/GIS interoperability
- G3D is designed for rapid display of big size IFC data based on GIS
- Characteristics of G3D
 - Including IFC geometry and property information
 - Relative coordinate + Georeference information(Latitude, Longitude, Altitude, Direction, Etc.)
 - LOD and spatial indexing information for rapid display
 - Geometry information based on file system
 - Property information based on database (ongoing)

Industry Foundation Classes (IFC) data model is intended to describe building and construction industry data. It is a platform neutral, open file format specification that is not controlled by a single vendor or group of vendors. It is an object-based file format with a data model developed by buildingSMART (formerly the International Alliance for Interoperability, IAI) to facilitate interoperability in the architecture, engineering and construction (AEC) industry, and is a commonly used collaboration format in Building information modeling (BIM) based projects



Designing Level of Detail(LOD)

- Newly defined LOD for BIM on GIS based on CityGML and BIM data type

Space	LOD	Geometry			Properties (Semantic LOD)
		BIM data	GIS data	Shape	
Outdoor	LOD0	-	<ul style="list-style-type: none"> Only terrain data DEM+orthoimage 		<ul style="list-style-type: none"> None
	LOD1	<ul style="list-style-type: none"> Boundary model Prismatic buildings Virtual texture 	<ul style="list-style-type: none"> DEM+orthoimage Prismatic buildings Virtual texture 		<ul style="list-style-type: none"> General properties
	LOD2	<ul style="list-style-type: none"> Boundary model Simple roof structures Photorealistic texture 	<ul style="list-style-type: none"> DEM+orthoimage Simple roof structures Photorealistic texture 		<ul style="list-style-type: none"> Floor specific properties
	LOD3	<ul style="list-style-type: none"> Boundary model +Parametric model Representation of precise Object Photorealistic texture 	<ul style="list-style-type: none"> DEM+orthoimage Representation of precise Object Photorealistic texture 		<ul style="list-style-type: none"> Exterior properties Facilities' exterior properties
Indoor + Outdoor	LOD4	<ul style="list-style-type: none"> Boundary model +parametric model Building envelope 	<ul style="list-style-type: none"> DEM+orthoimage Representation of precise Object Photorealistic texture 		<ul style="list-style-type: none"> Building envelope properties
Indoor	LOD5	<ul style="list-style-type: none"> Parametric model Building envelope 	-		<ul style="list-style-type: none"> All properties of buildings
	LOD6	<ul style="list-style-type: none"> Furniture, MEP model Irregular shaped objects 	-		<ul style="list-style-type: none"> All properties of buildings



Technology for Rapid Display

- Simplification, Hierarchical, and Data Streaming are required for rapid display.

Simplification

Hierarchical LOD generation throughout applying simplification algorithm

- Simplification of building inside
- Simplification of building envelope

Building inside objects simplification and LOD creation

Building outside objects simplification and LOD creation

Hierarchical Data Structure

Data structure throughout spatial indexing based on Octree

- Spatial division method based on Octree for spatial query about building objects
- Applies Octree to all LOD including interior and exterior

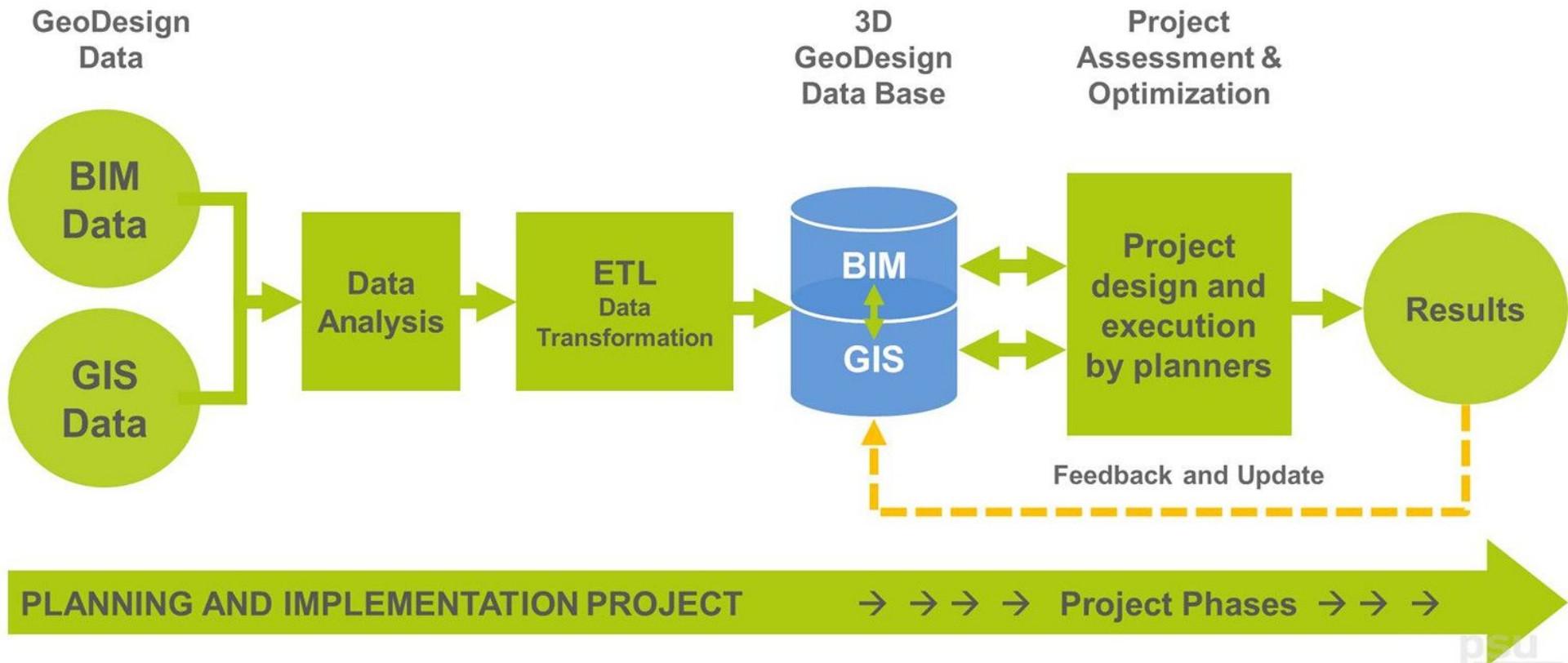
Object Index construction		
Level 1	Level 2	...
NODE 0	NODE 01	NODE 02
NODE 03	NODE 04	NODE 05
NODE 06	NODE 07	NODE 08
NODE 09	NODE 10	NODE 11
NODE 12	NODE 13	NODE 14
NODE 15	NODE 16	NODE 17
NODE 18	NODE 19	NODE 20
NODE 21	NODE 22	NODE 23
NODE 24	NODE 25	NODE 26
NODE 27	NODE 28	NODE 29
NODE 30	NODE 31	NODE 32
NODE 33	NODE 34	NODE 35
NODE 36	NODE 37	NODE 38
NODE 39	NODE 40	NODE 41
NODE 42	NODE 43	NODE 44
NODE 45	NODE 46	NODE 47
NODE 48	NODE 49	NODE 50
NODE 51	NODE 52	NODE 53
NODE 54	NODE 55	NODE 56
NODE 57	NODE 58	NODE 59
NODE 60	NODE 61	NODE 62
NODE 63	NODE 64	NODE 65
NODE 66	NODE 67	NODE 68
NODE 69	NODE 70	NODE 71
NODE 72	NODE 73	NODE 74
NODE 75	NODE 76	NODE 77
NODE 78	NODE 79	NODE 80
NODE 81	NODE 82	NODE 83
NODE 84	NODE 85	NODE 86
NODE 87	NODE 88	NODE 89
NODE 90	NODE 91	NODE 92
NODE 93	NODE 94	NODE 95
NODE 96	NODE 97	NODE 98
NODE 99	NODE 100	NODE 101

Data Streaming

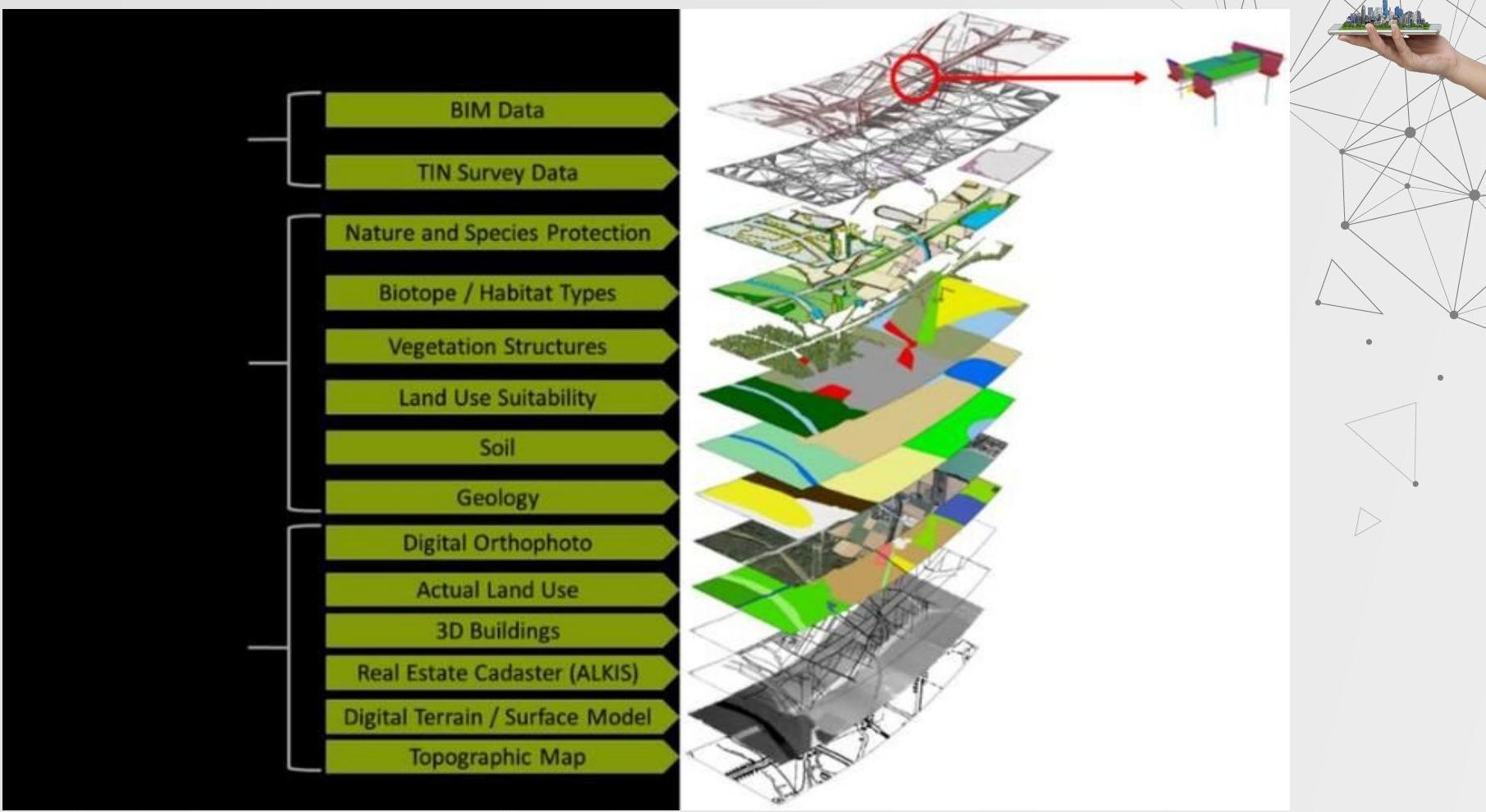
High speed rendering throughout data streaming and visualization

- Proper LOD level display from screen division
- Improving rendering speed throughout loading necessary data
- Multi-threading
- Efficient memory resource management

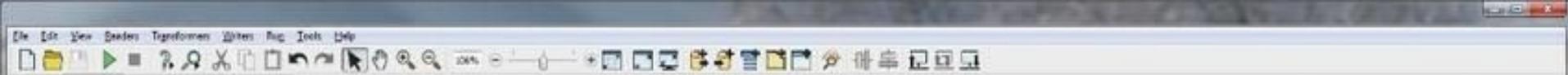
- Best Screen Division
- Data Search/Compression/Sending
- Hierarchical LOD
- Cont. Screen Display
- Effective Memory Mgmt.



The integrated data exchange concept



Integration of BIM data and GIS environmental planning data

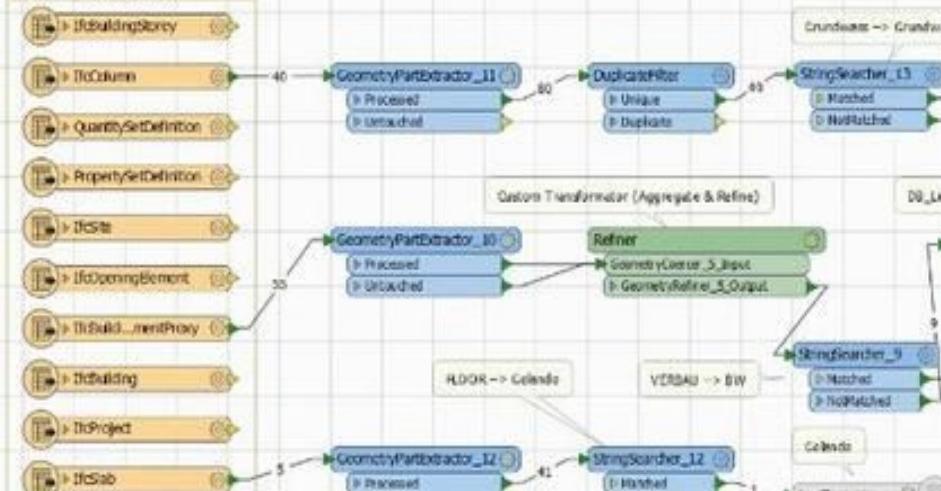


BIM Data

Transformation

2D/3D GIS Database

EW27-1_306_20160728



Extract

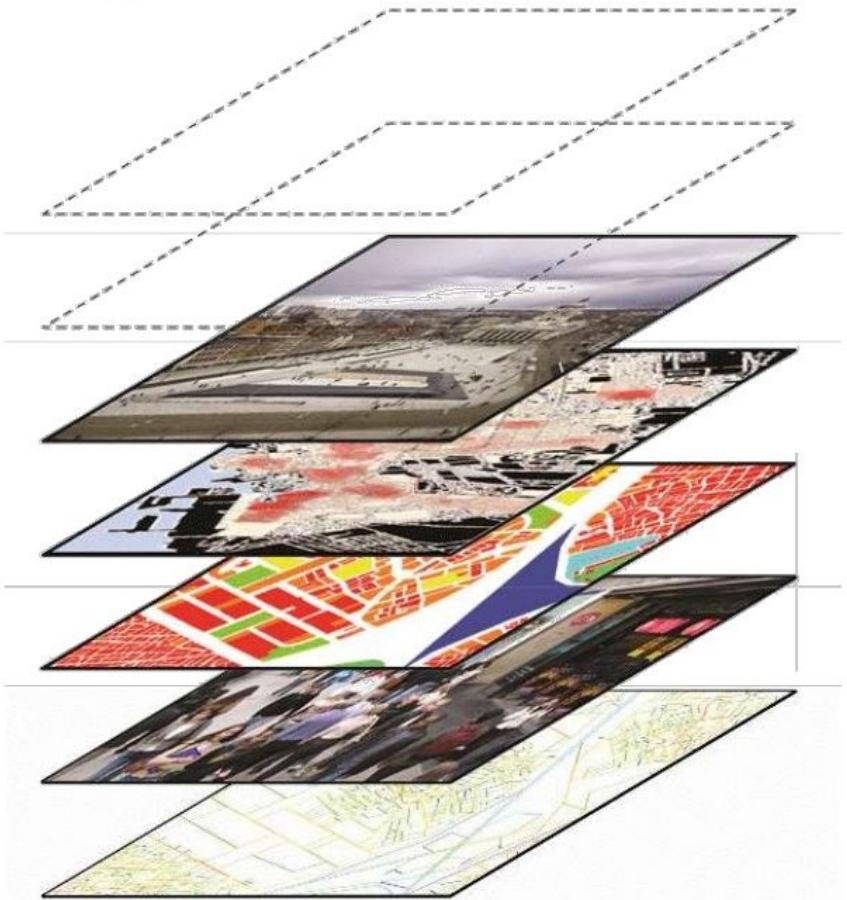
Transform

Load

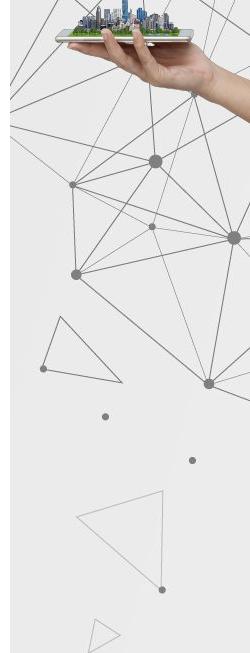


Integration of Autobahn A99 BIM data (circled bridge) into the 3D GIS and environmental planning data model

Integrated Urban Model



- 5. Carbon Emissions**
- 4. Land Value**
- 3. Crime & Safety**
- 2. Land Use**
- 1. Movement**
- 0. Spatial Layout**



The big challenge is communication

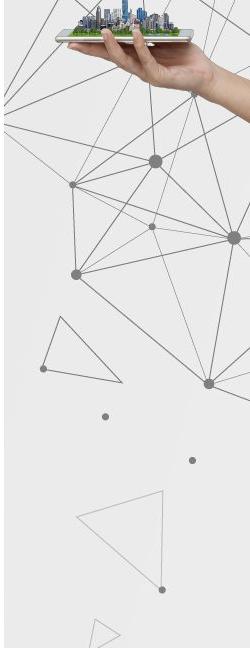
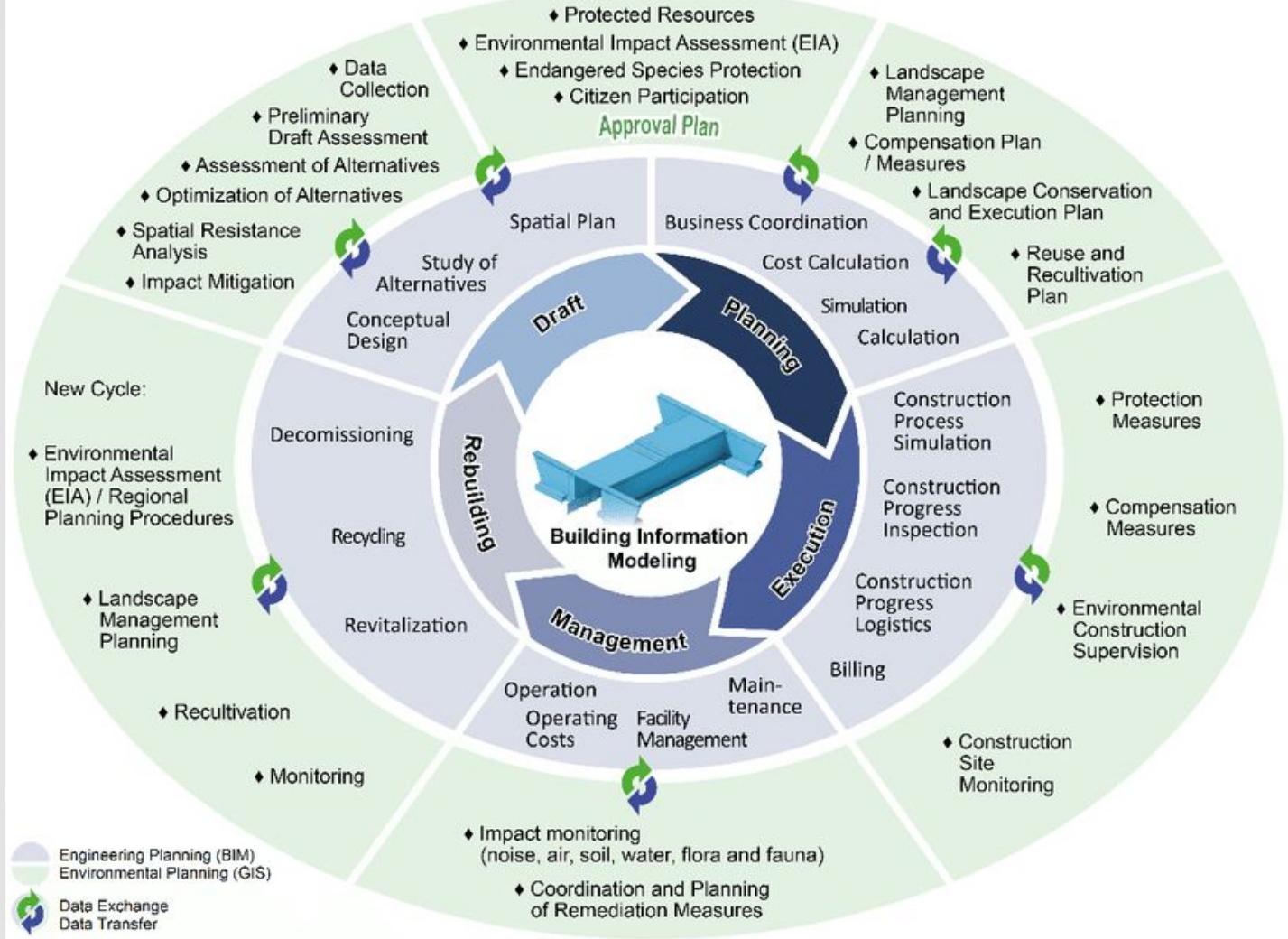
- Between systems
- Between data formats
- Between organisations
- Between disciplines
- Between different roles



International
Organization for
Standardization

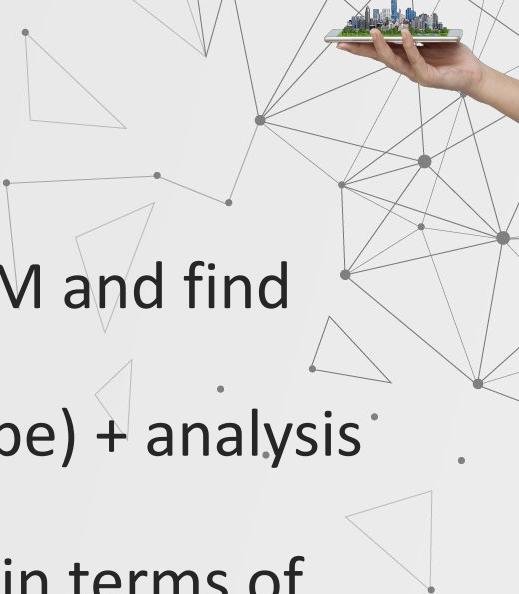


 buildingSMART®
International home of openBIM



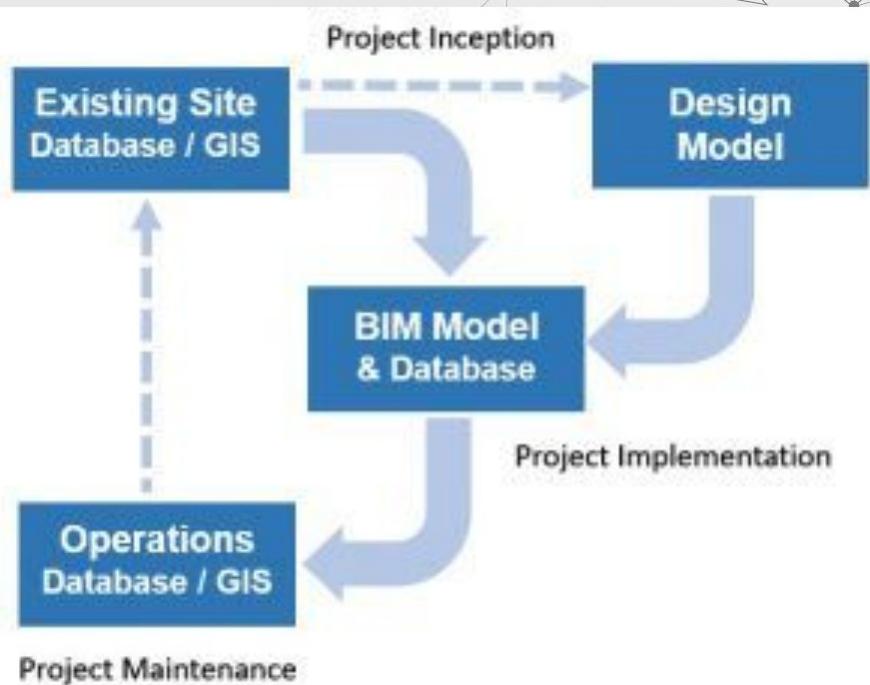
Background

- Usage of GIS is still in growing state.
- Organisations are trying to conceptualise BIM and find ways to use this technology
- Coding in every details of a building (any type) + analysis is BIM.
- It needs very detailed attribute information in terms of design specifications, standards and rules well before the development of the asset.



Perceived value

- GIS and BIM are seen as technical tools for improving designs.
-

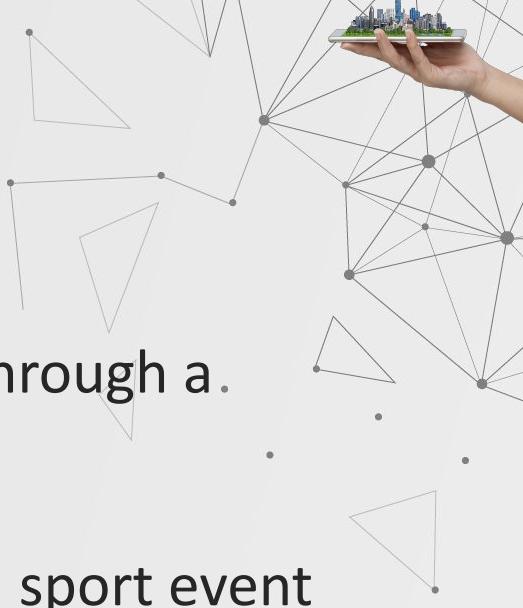


Why to Integrate

- To understand the need for integration lets run through a example.

Case:

A fast developing city selected to be host of a global sport event in 2022, geared up to spend US\$75b in 12 years time. As part of the preparation host city wants to develop some part of city and create a world class living, business and entertainment district.



Full cycle sustainable development

Scope of the project is to deliver design & develop a green field site of about 80 sq.km

Urban design
&
Architecture

Detailed
Engineering

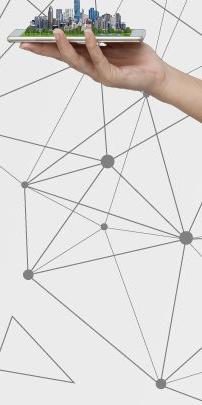
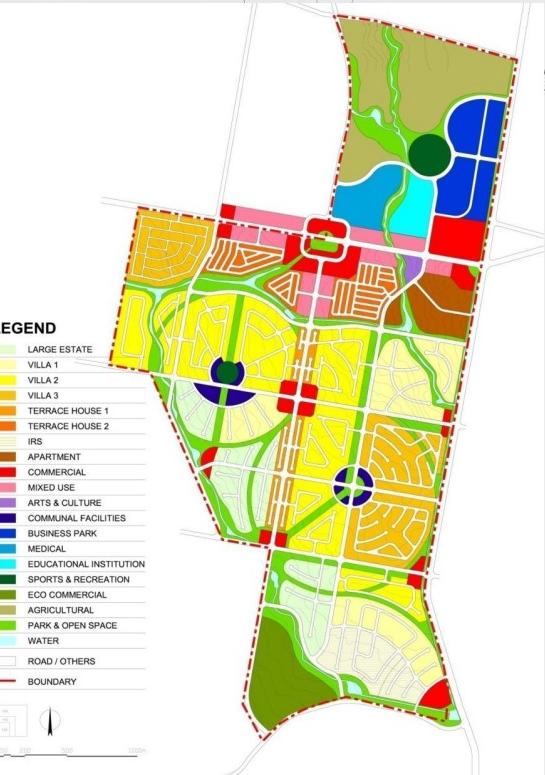
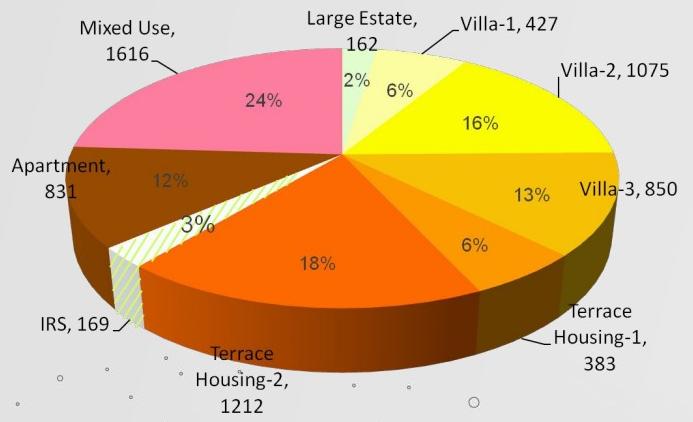
Construction

Maintenance

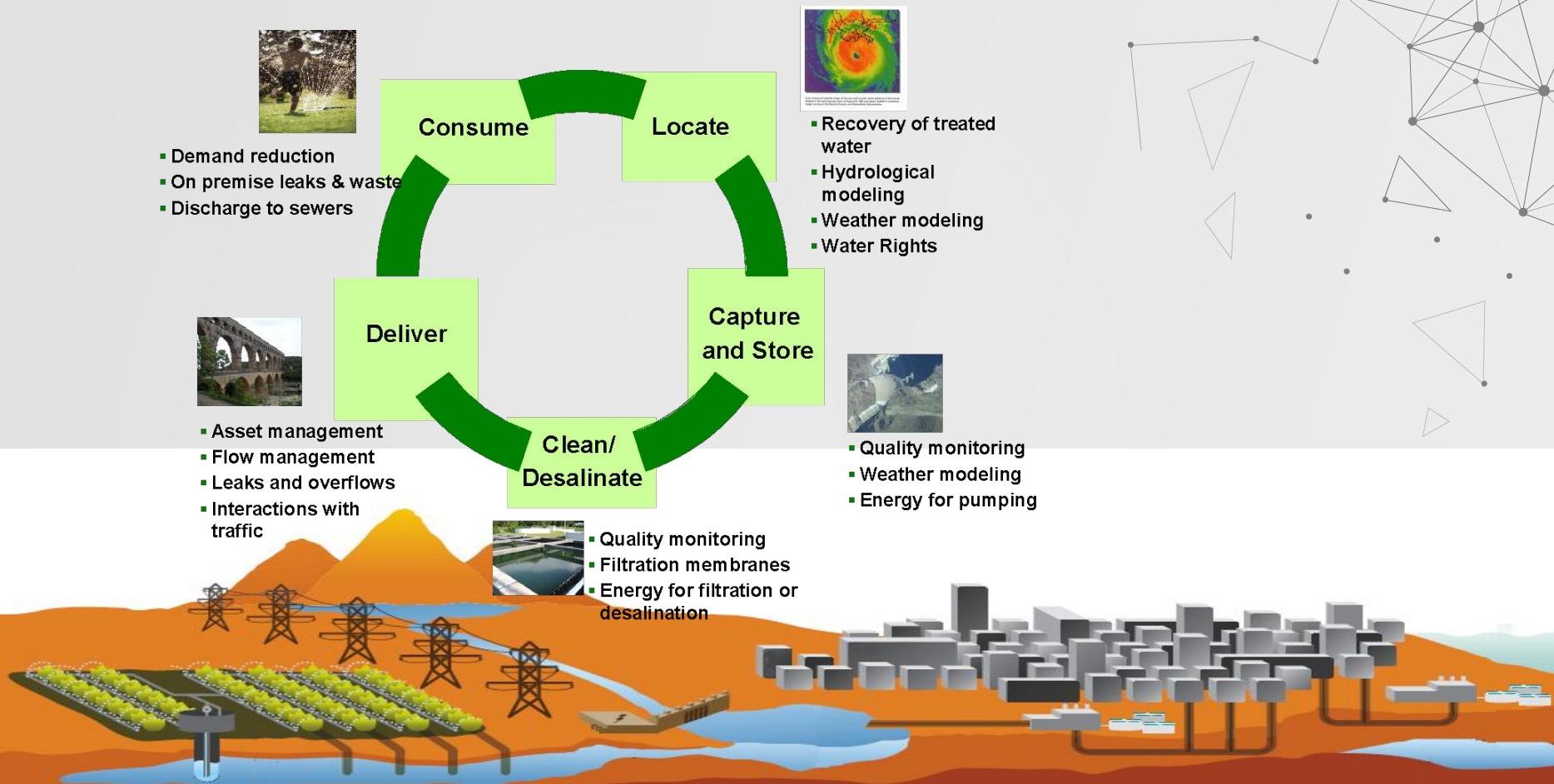


Land use plan & Zoning

DEVELOPMENT QUANTUM: DU



Example: The Urban Water Cycle



Systems Effects and Resources

Constraints

- “Slack” or excess capacity produces weak interactions
- Interactions become stronger when resources are constrained
- Under severe constraints – tipping points
- Examples:
 - Energy: MASDAR, Malta, Canary Wharf/London, Lower Manhattan....
 - Water: Middle East, US Western States, China (2030)
 - Transportation: Mexico City, Stockholm, China, India
 - Finance: <pretty much everywhere>
 - Economic Development: <pretty much everywhere>
- Conclusion: In the future, we need to take a systems view of the development and management of cities and regions

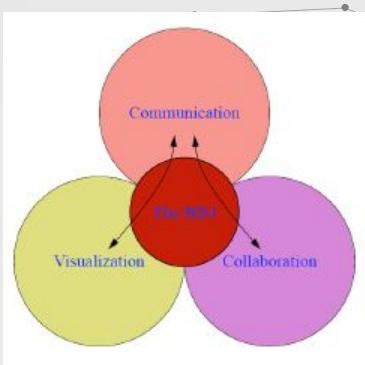


The BIM is a tool which facilitates the flow of information and helps to create understanding and collaboration.

The three primary ‘project enabling’ principles are:

1. **Visualization** – the ability to form a picture in our head based on understanding information.
2. **Communication** – the transfer of information which leads to understanding.
3. **Collaboration** – the mutual support which leads to common understanding and positive action.

Communication connects Visualization to Collaboration.



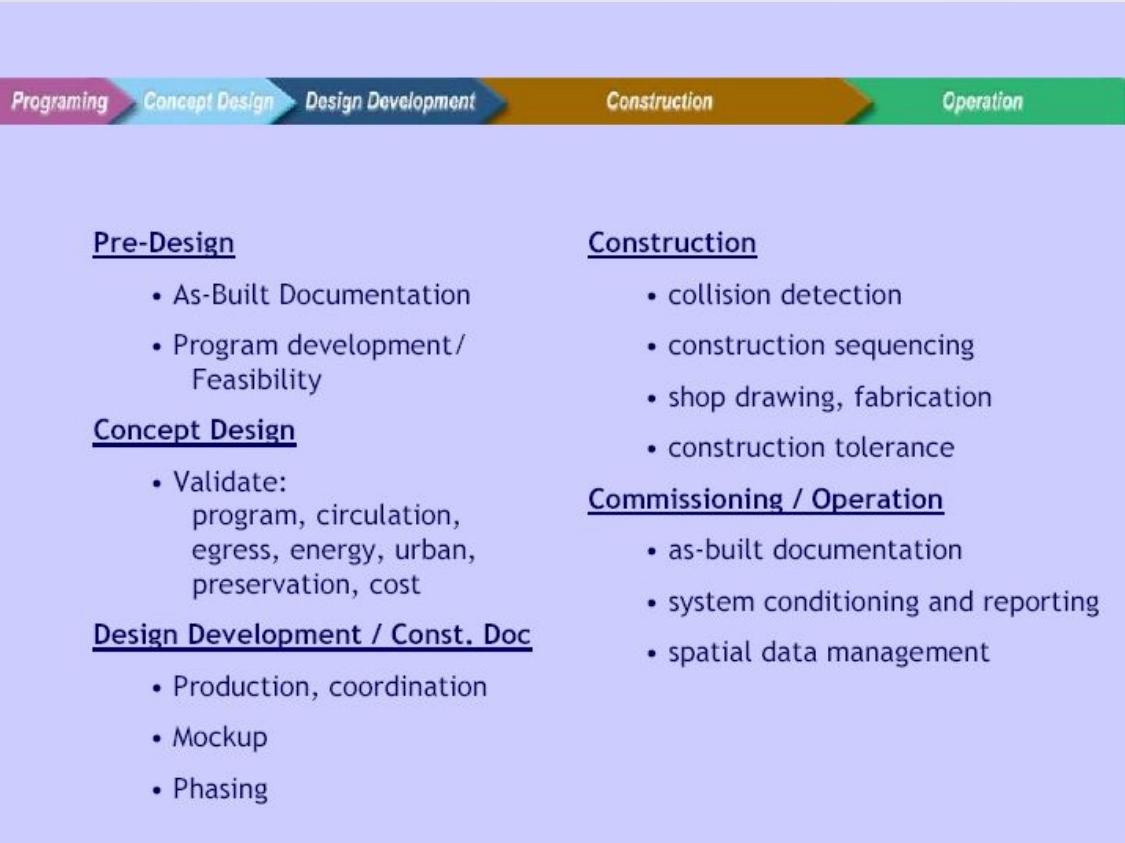
“Creating the BIM is an action which will generate more understanding of the project particulars than any other activity related to the design and construction process.”

“A BIM is as good as the (both project and process) understanding of the team which creates it.”

Outline for a BIM Curriculum.

By Willem Kymmell, architect
Assoc. Prof. Construction Management
Founding partner - Construction Simulation Lab
CSU Chico, Chico, CA
wkymmell@csuchico.edu

BIM as an integrative



BIM Levels of Information

Stepped Strategy of Data Collection and Modeling

Minimal level of data modeling necessary to integrate BIMs with other data?

Surprising little is needed to get the highest value from the BIMs.

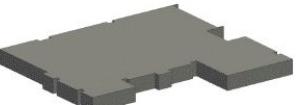
Value comes over time in a logical stepped sequence of data collection.



Simple Mass Defining Total Square Footage 16,900 SF



Mass With Rough Outline Defining Total Square Footage 16,900 SF

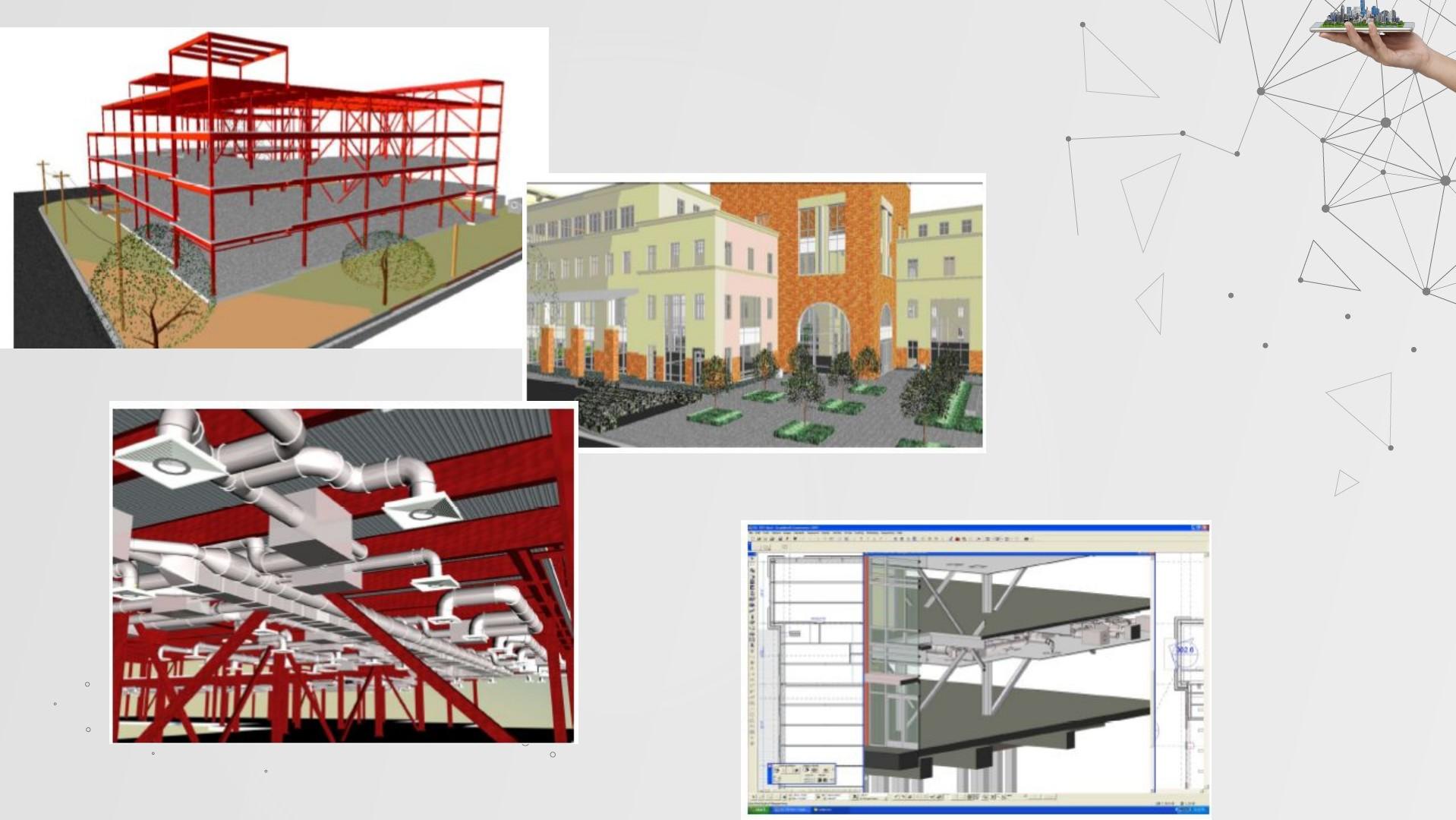


Mass Accurate Outline Defining Total Square Footage 16,900 SF



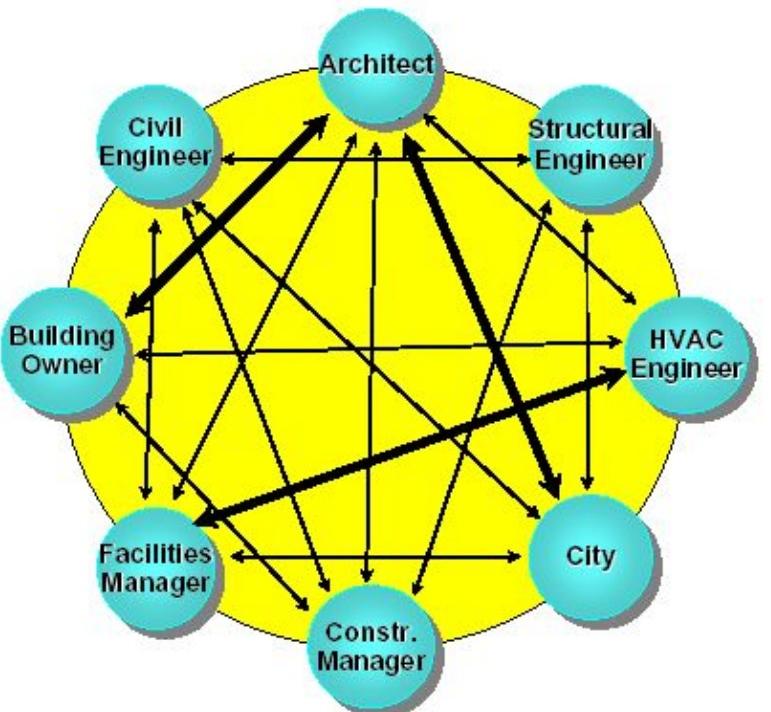
All of the levels can reference data that exists in other levels of detail.





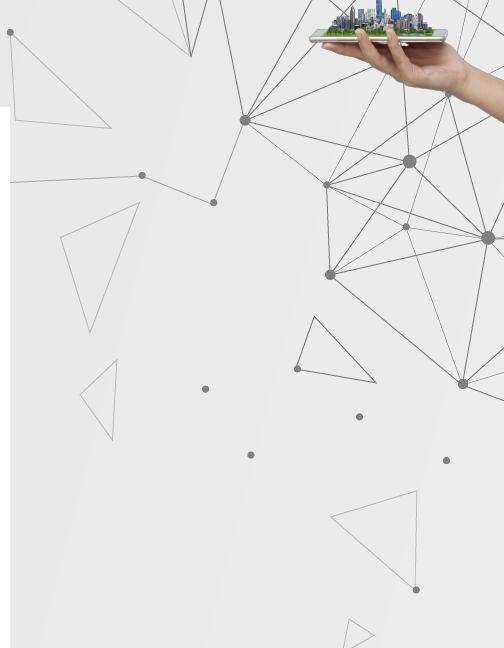
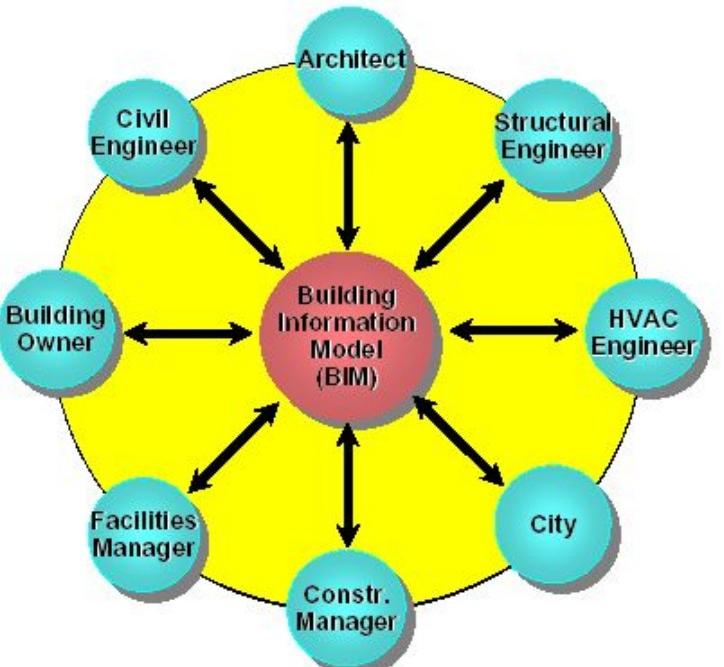


Traditional Information Exchange





buildingSMART Information Exchange



Pushing the Standards Edge: Collaborative Testbeds to Accelerate Standards Development and Implementation

What Drives OGC Standards Development?



Tackling major interoperability challenges of next-generation data / service sharing and collaboration....



Developing new specifications for location-based services interoperability and spatially enabling the systems and enterprises



Working across standards consortia to accomplish mission objectives



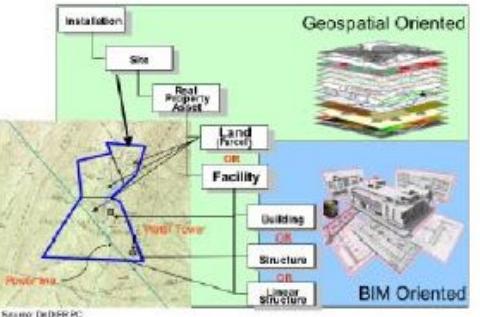
OWS-4 CAD / GIS BIM Integration

BIM In Context for Project Development



AEC Projects will benefit by integrating BIM in geospatial context throughout **project** lifecycle:

- Initial ground condition from OGC Standards Based systems will aid in initial site planning
- Existing and surrounding site buildings may be delivered as CityGML, an XML encoding based on OGC's Geography Markup Language
- Detailed engineering connections and conflicts may be understood and modeled by integration of BIMs of neighboring sites



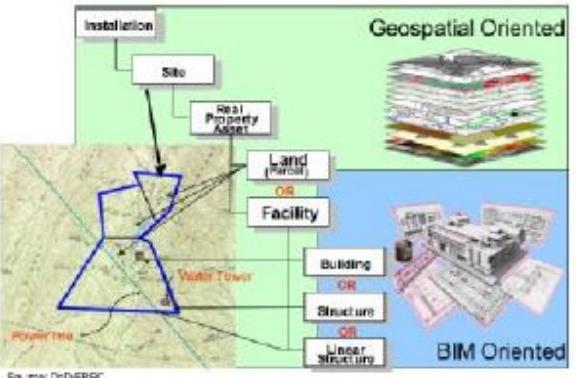
OWS-4 CAD / GIS BIM Integration

BIM In Context for Project Development



Broad-scale assessment will be facilitated by integration of information aggregated from **multiple** BIMs:

- Space Planning
- Facilities Management / Security
- Build-Out Analysis
- Emergency Planning/Management
- Detailed, 4-D Virtual City Application



<http://www.opengeosp>

CAD / Geospatial / 3D Integration



Open Standards approach to sharing of information and services between AEC / CAD and geospatial technologies

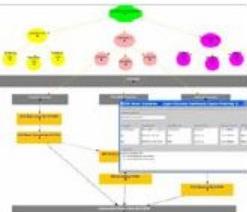
Critical for Urban Planning, Emergency Response, Homeland Security, Defense and Intelligence, site planning, Maintenance, Engineering...





General Services Administration

Public Buildings Service



Images from GSA Pilot Project applications of 3D, 4D, and BIM technologies

- Increased Security Requirements
 - Rising Energy Costs
 - Cost of Construction Materials
 - Changing Customer Requirements

GSA's mission is to "help federal agencies better serve the public by offering, at best value, superior workplaces, expert solutions, acquisition services and management policies."

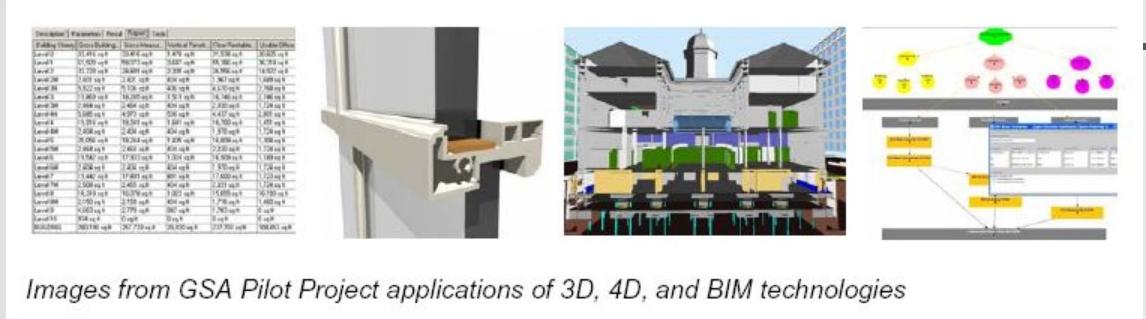
Challenges Facing the Organization

- Helps Customers Make Informed, Rational Security Decisions
- ID Security Gaps
- Aligns with Interagency Security Committee Design Criteria

- Plan & Mitigate Risk
- Identify Gaps in the Design Phase
- Identify Whether Designs Meet Specific Objectives and Criteria
- Identify Problems with the Project Budget
- Communication Tool for Customers



Challenges can be the stimulus for creative ideas and new



Images from GSA Pilot Project applications of 3D, 4D, and BIM technologies

- US General Services Administration (GSA),
- ‘virtual building models’
- use and deliver **digital datasets** for facility operations, maintenance and renewal;
- support improved service delivery, enhanced emergency planning, management and response.



CAPITAL INVESTMENT & LEASING PROGRAM CALL



FY 200

U.S. General Services Administration
GSA Public Buildings Service
Office of Real Property Asset Management<http://rw-qpsel-oca.gsa.gov>

GSA

Public Buildings Service
Office of Real Property Asset Management

Multi-Phase R&A Projects

Design Build

Expert Choice

5-Year Capital Reinvestment Plan

SUMMARY OF R&A REQUIRED DOCUMENTATION

SUBMITTED BY THE REGIONS INTO THE PIP

Prospectus

Housing Plan

Feasibility Study

Program Development Study

Project Management Plan

Project Data Sheet

The Automated Prospectus System

GCCRG Cost Benchmark Tool

Pro Forma

Appraisal

Any MVA appraisal that does not in instructions will decrease the project cost

Project Cost Estimating Tool

Design & Construction Professional

Project Definition Rating Index (PDR)

LEED Certification

Environmental Review Sheet

Exhibit 300

Judiciary Impact Statement

Occupancy Agreements

UPDATED ONLINE

Asset Business Plans (ABP)

Building Preservation Plan (BPP)

Level IV Weatherization

INCORPORATED INTO THE FEASIBILITY STUDY, PDS, and PMP

Building Commissioning

Startups and Industry Publications/Codes (IPC) - Based Building Information Model

Mobile CRM

Hazardous Materials Studies

Security Studies- Progressive Collapse, Blast/Window Vulnerability

Seismic Studies

REQUIRED DOCUMENTATION - BORDER STATION NEW CONSTRUCTION

Summary of Border Station Required Documentation - TBD

SUBMITTED BY THE REGIONS INTO THE PIP - TBD

REQUIRED DOCUMENTATION - COURTHOUSE NEW CONSTRUCTION

Summary of Courthouse New Construction Required Documentation

SUBMITTED BY THE REGIONS INTO THE PIP

Prospectus

PBS OCA 3D-4D-BIM Program

FedBizOpps:

For all prospectus projects receiving design funding in **FY2007 and beyond**, a **spatial program** Building Information Model will be the **minimum requirement** for all new and modernization projects that will be submitted to Commissioner of the Public Buildings Service for **Final Concept approvals**.

Creating a Standard for BIM

- The NBIMS Project Committee seeks to facilitate integration by providing a
 - common **language for describing facility information**
 - common **views of information** based on the needs of businesses engaged in all aspects of facility commerce
 - common **standards for sharing data** between businesses and their data processing applications.
- expected to significantly reduce
 - building costs
 - insurance liability
 - construction schedules
 - operating expense
- expected to significantly increase
 - building performance
 - safety, building life
 - occupant efficiency



partnering and collaboration

- International standards organizations include the
- National Building Information Model Standard (NBIMS), National Institute of Building Standards (NIBS)
- Open Standards Consortium for Real Estate (OSCRE),
- Open Geospatial Consortium, Inc. (OGC®),
- International Alliance for Interoperability (IAI) International, and
- FIATECH – an industry consortium formed to identify and accelerate the development, demonstration and deployment of fully integrated and automated technologies.
- American Institute of Architects (AIA),
- Building Owners & Managers Association (BOMA),
- Construction Specifications Institute (CSI),
- Construction Users Roundtable (CURT),
- International Facilities Management Association (IFMA),
- Mortgage Bankers Association, etc.



For information to be useful it must adhere to open standards.

- The beneficiaries of BIM include
 - owners, planners, realtors, appraisers, mortgage bankers, designers, engineers, prototypers, estimators, specifies, safety, occupational health, environmentalists, contractors, lawyers, contract officers, sub-contractors, fabricators, code officials, operators, risk management, renovators, first responders and demolition.
- Each has their own view of the information, many share the same information but some have unique uses.
 - Some supply information,
 - some use information
 - some do both, supply information and use information



Problem - Building Documentation is Fragmented . . .

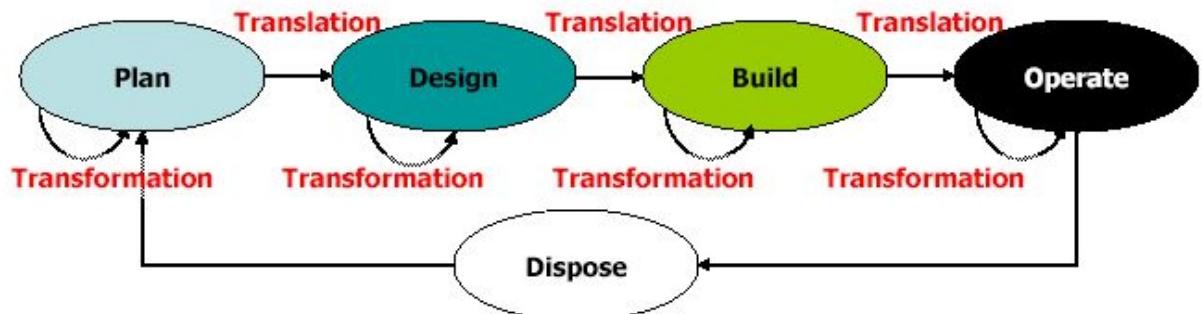
- architects design, constructors construct, and building managers manage in isolation.
- Architects, Engineers and Construction Contractors each submit design plans,
- operating instructions and repair manuals in hardcopy
- which must be organized and maintained in order to support building operations, maintenance and renovation throughout the building's life
- The vision is to reengineer the fragmented building industry to seamlessly integrate all building project phases within a BIM concept.
- Thus, the aim of BIM is to integrate, standardize, and codify best practices within all phases of the building industry.
- The goal is to create an infrastructure to capture, organize and mine that information.



Various documents share same information structures , however, information generated in each document cannot directly be transferred to another application or cross-referenced



Problem - Critical data is lost ...



- decisions made as ideas & parts are **transformed** into designs & buildings are not captured
- **translation** of information for downstream use loses much of what is known during the previous phase

NIST Study on Cost of Inadequate Interoperability



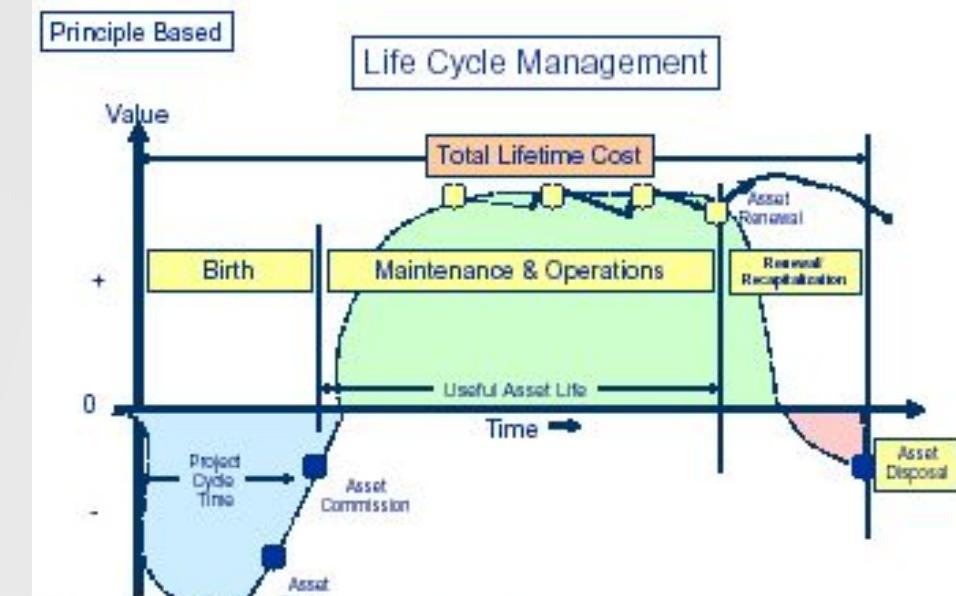
- 2004 NIST study (U.S. Department of Commerce, National Institute of Standards and Technology, “Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry”. (NIST GCR 04-867, August 2004) estimates that at least \$15.8B is lost annually due to the lack of interoperability.
<http://www.bfrl.nist.gov/oae/publications/gcrs/04867.pdf>

Interoperability is the ability to share and manage information between project stakeholders.

- Currently, BIM is envisioned as an approach to **data integration (interoperability)**, a central repository of continuously available up-to-date integrated information on building design, construction, and management.
- However, for BIM to be effective and replicable, agreement on the concepts must be achieved and codified within suitable computable technologies that are organic and adaptable to changing circumstances.



BIM is intended to be a open standards based repository of information for the facility owner/operator to use and maintain throughout the life-cycle of a facility.



Engineering, Construction, and Facilities Asset Management: A Cultural Revolution





National Institute of
Building Sciences

National Building Information Model Standard

Based on and supporting



Industry Foundation Classes
Information Delivery Manuals
and International Framework for Dictionaries

BIM: Pushing Standards To The Edge

National

Building Information Model

Standard

Deke Smith, RA

Chair, NIBS National BIM Standard Project Committee

Federal Facilities Council

October 31, 2006

This presentation is a collaborative product of the NIBS NBIMS Project Committee.

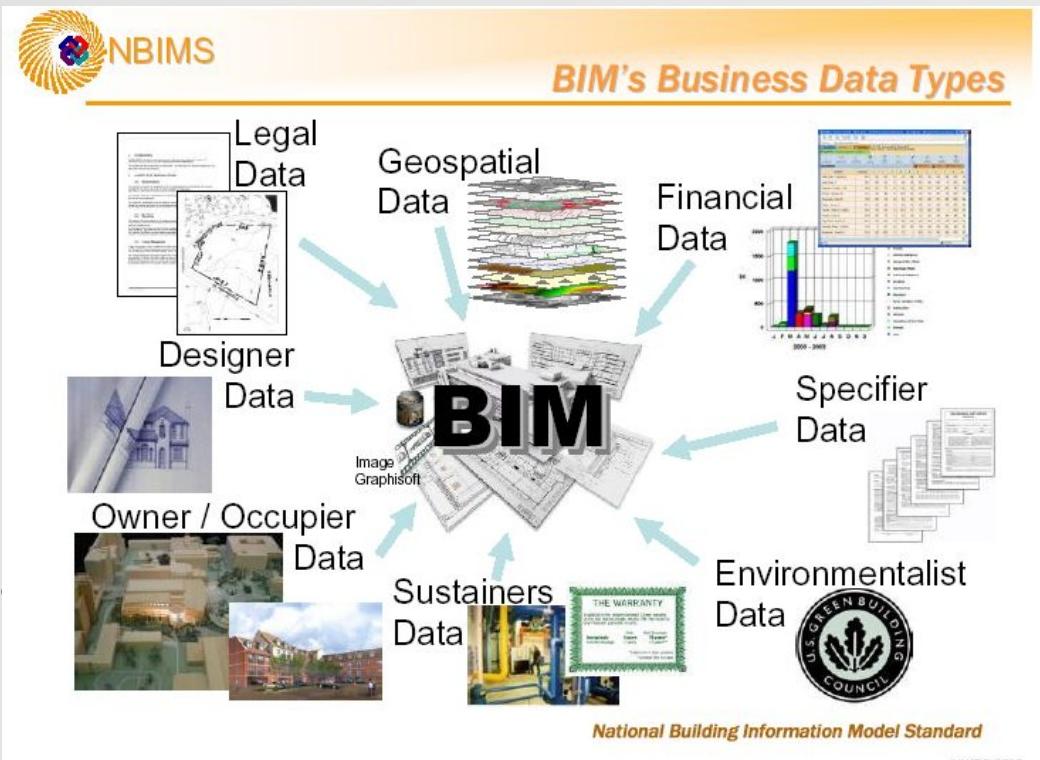
National Building Information Model Standard

© NIBS 2006



Define expansive scope of BIM

- Everyone starting from different points of view
- Breaking down stovepipes
- Developing awareness and appreciation of life-cycle approach





BIM Enabled Construction Industry



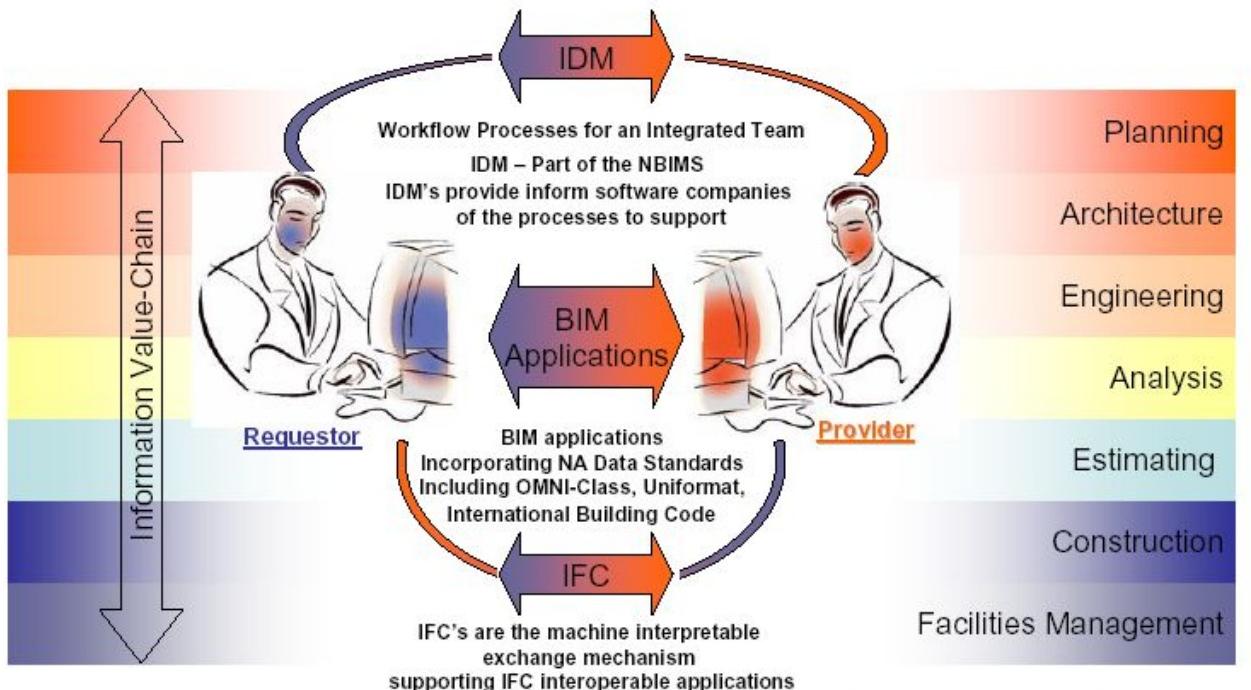
Facility Information Views

Owners
Planners
Realtors
Appraisers
Mortgage Bankers
Designers
Engineers
Cost & Quantity Estimators
Specifiers
Contracts & Lawyers
Construction Contractors
Sub-Contractors
Fabricators
Code Officials
Facility Managers
Maintenance & Sustainment
Renovation & Restoration
Disposal & Recycling
Scoping, Testing, Simulation
Safety & Occupational Health
Environmental & NEPA
Plant Operations
Energy, LEED
Space & Security
Network Managers
CIO's
Risk Management
Occupant Support
First Responders

National Building Information Model Standard



Developing the BIM Value-Chain



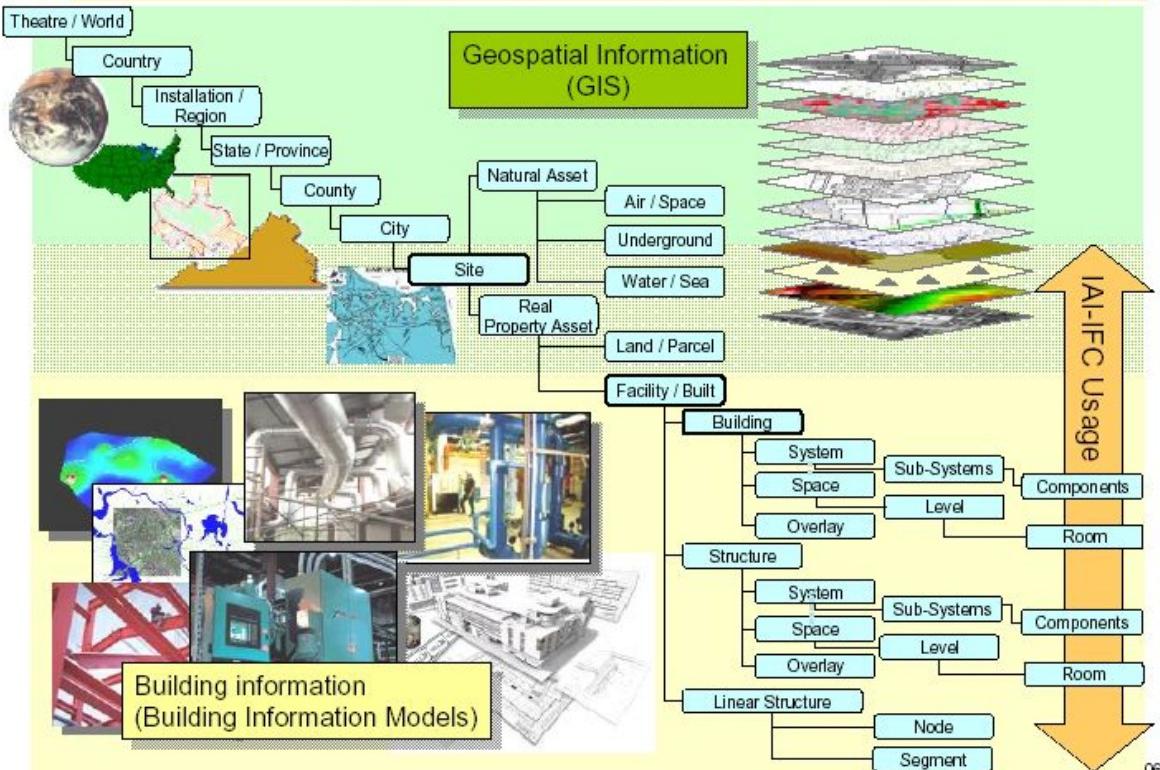
National Building Information Model Standard

© NIBS 2006



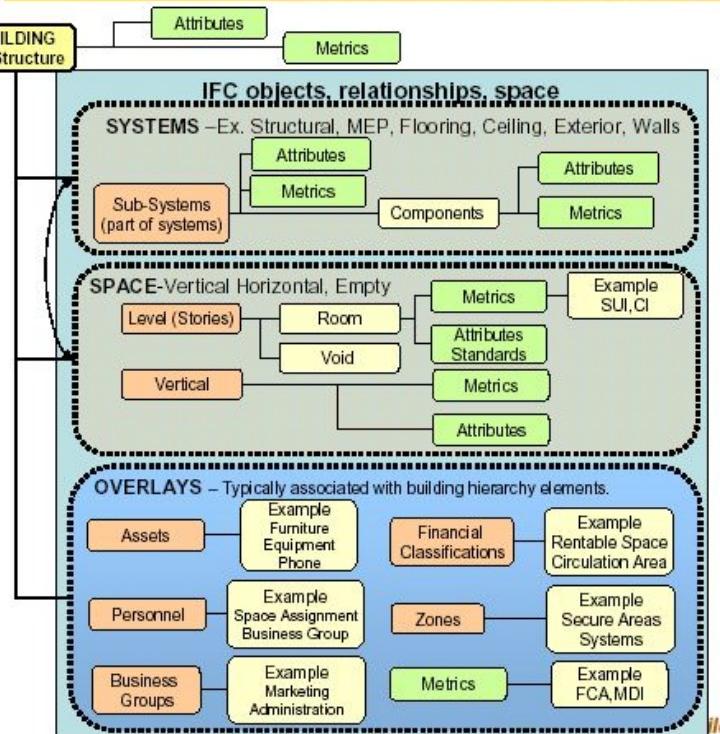


Hierarchical Information Relationships





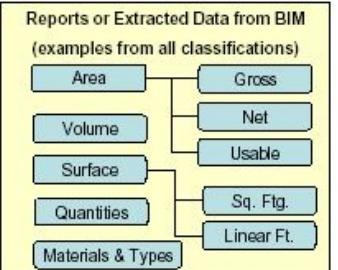
Hierarchical Building Information Relationships



Systems represent the physical entities of the building. Systems use NA classifications such as Omni-Class and Uniformat and are transported/exchanged via IFCs

Space is physical in nature, but can be unbounded (have no or cross physical boundaries) but it will always be tied to the physical structure or systems in some way

Overlays are more abstract data - organizational, operational, functional, financial, non-fixed assets, resources, personnel, etc. that is data tied to the Systems and Space



Building Information Model Standard





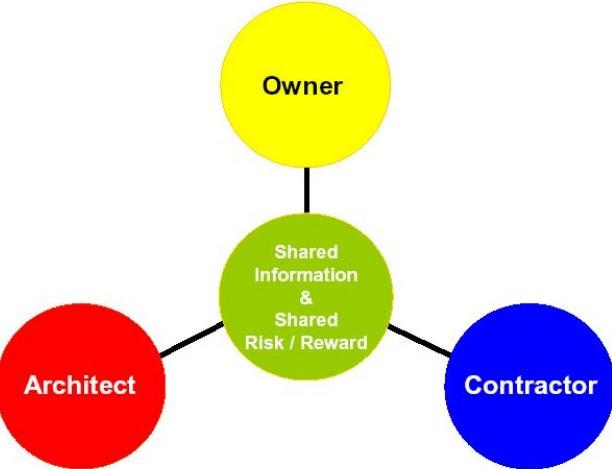
- Patrick MacLeamy, FAIA
- CEO, HOK
- International Chairman, IAI

buildingSMART organization

buildingSMART design

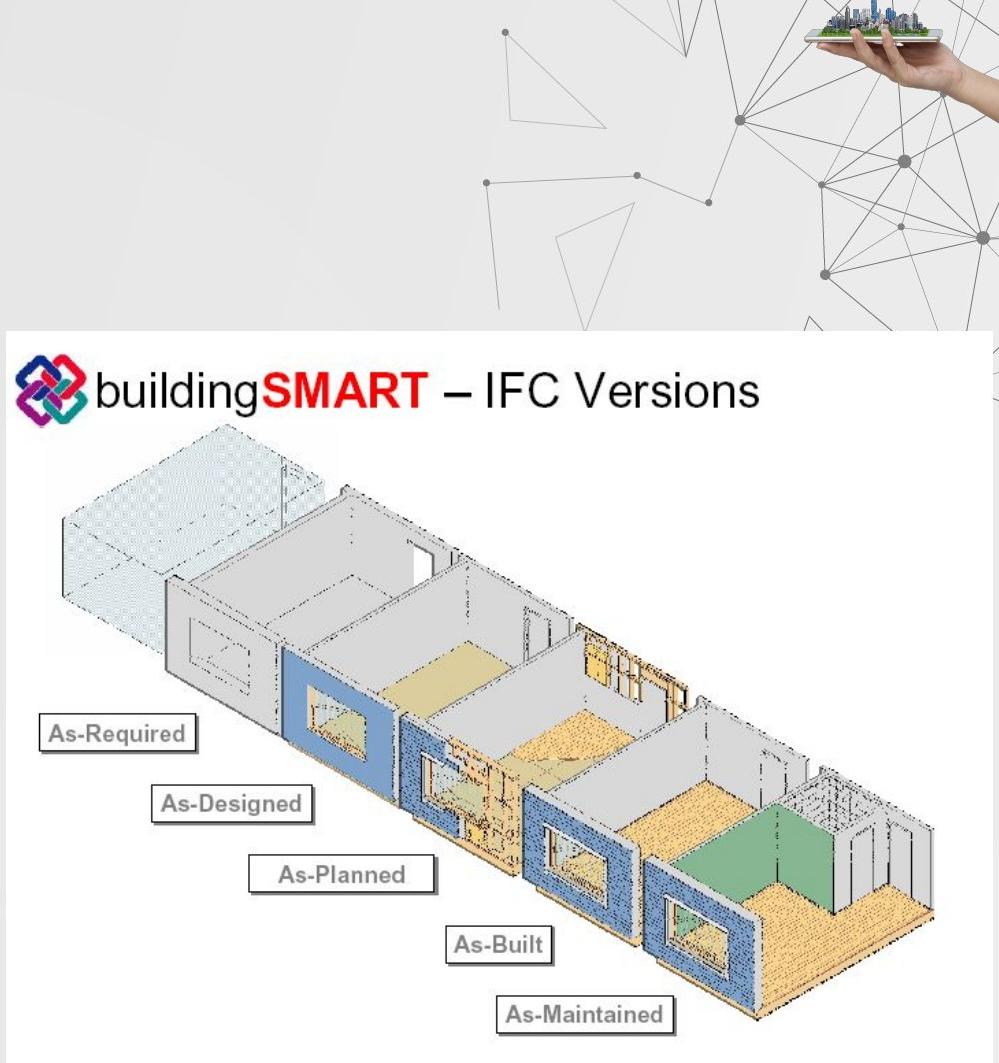
buildingSMART information exchange

buildingSMART Organization



IAI Mission

- Promote efficiency in the building industry
- Support open standards for information exchange
- Encourage buildingSMART adoption worldwide
- Develop a universal translator (IFCs)



buildingSMART with COBIE

Bill Brodt, NASA

Bill East and Jeff Kirby, USACE ERDC



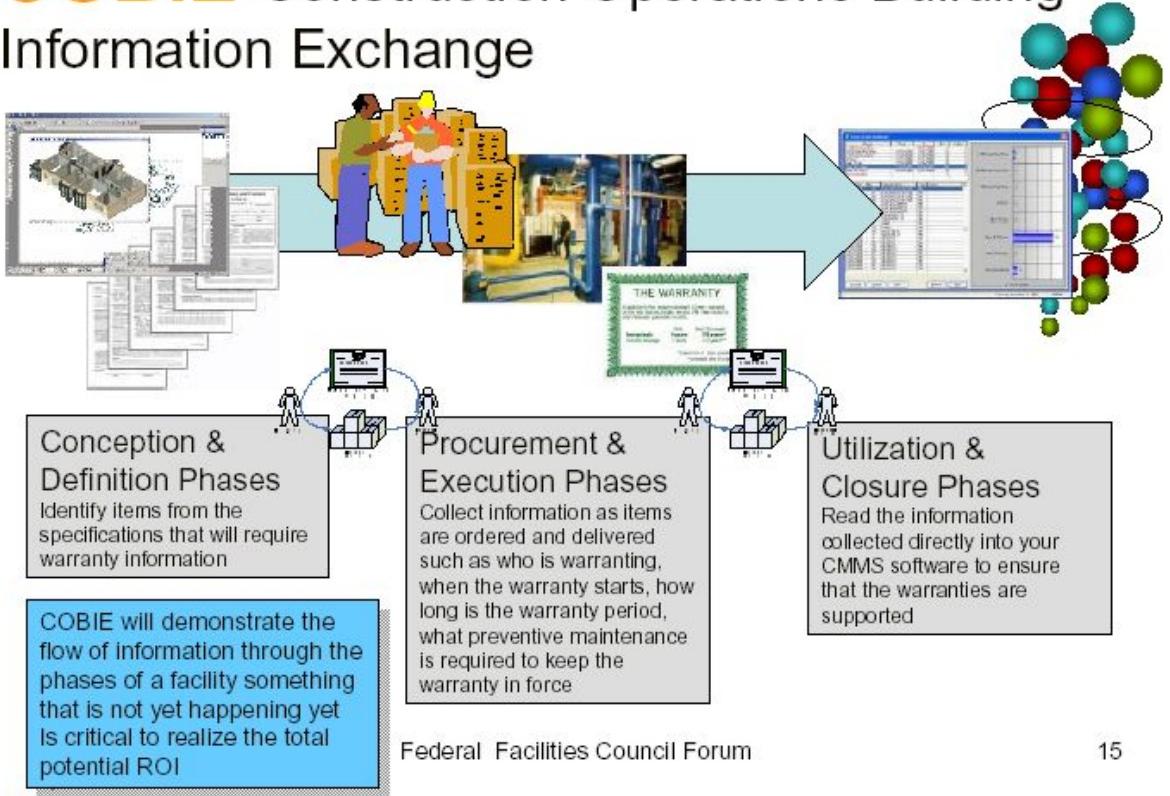
Federal Facilities Council Forum 10/31/2006

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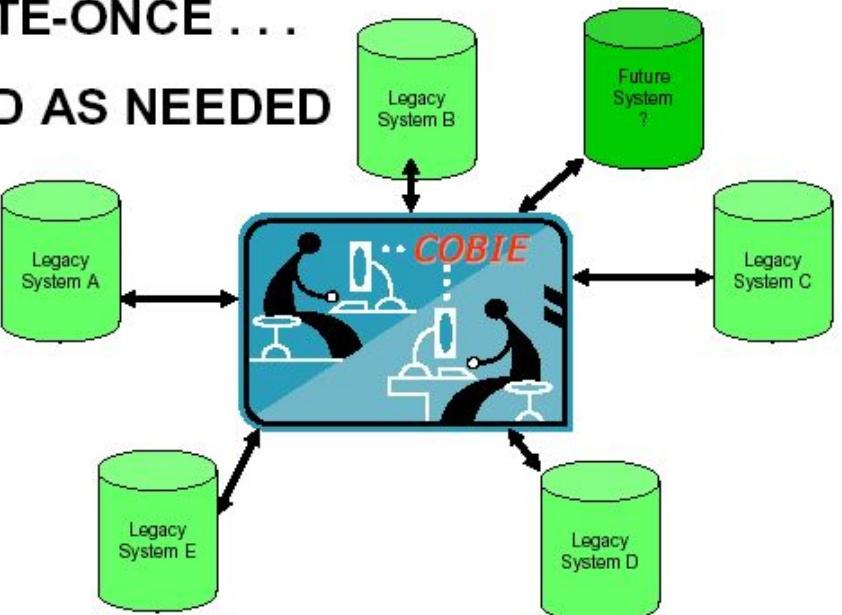
COBIE Overview Briefing:
http://nbims.opengeospatial.org/files/?artifact_id=352



COBIE Construction Operations Building Information Exchange



COBIE uses internationally recognized
standard and data definitions requirements . . .
WRITE-ONCE . . .
READ AS NEEDED



Captures Information at Source



Designers, Constructors &

Digitized by srujanika@gmail.com



Technical Data

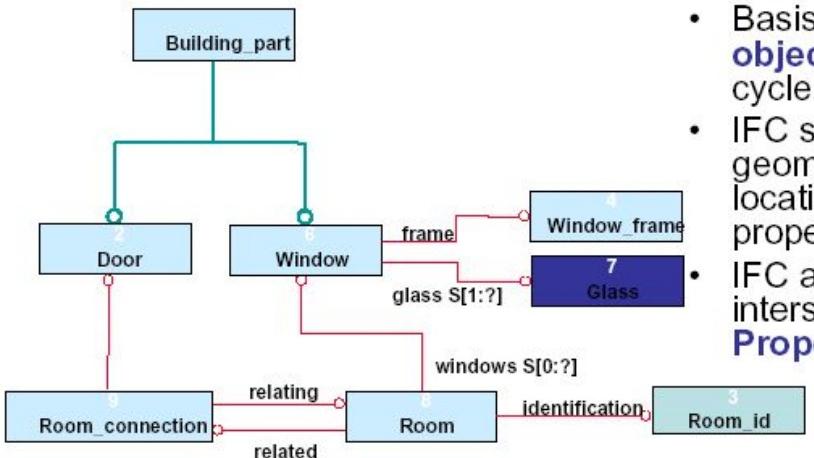
- PDF format
 - link to URL
 - or XML database

The IAI IFCs (Industry Foundation Classes)

- The classes defined by the IAI are termed Industry Foundation Classes (IFCs) for the following reasons:
- IFCs are defined by the AEC/FM **industry**. These specifications represent a data structure supporting an electronic project model useful in sharing data across applications.
- They provide a **foundation** for the shared project model
- They specify **classes** of things in an agreed-upon manner that enables the development of a common language for construction.
 - specify how "things" that could occur in a constructed facility should be represented electronically.
 - The word "class" describes a range of things with common characteristics. For instance, every door has the characteristics of opening to allow entry to a space
 - Class describes real things such as doors, walls, and fans as well as abstract concepts such as space, organization, information exchange, and process).
 - Class can also describe abstract concepts such as space, organization, information exchange, and process.



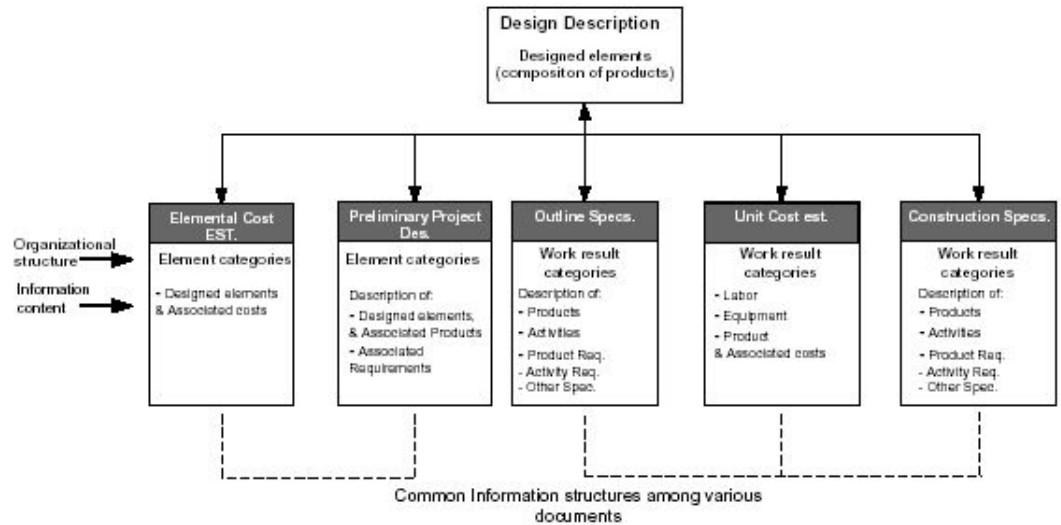
Industry Foundation Classes



- Set of internationally standardized **construction industry object definitions**
- Basis – **integration of objects** across project life cycle using a single model
- IFC stores **object data** – geometry, 3D dimensions, location, relationships, properties
- IFC and *OmniClass* intersect in **Elements** and **Properties Table**

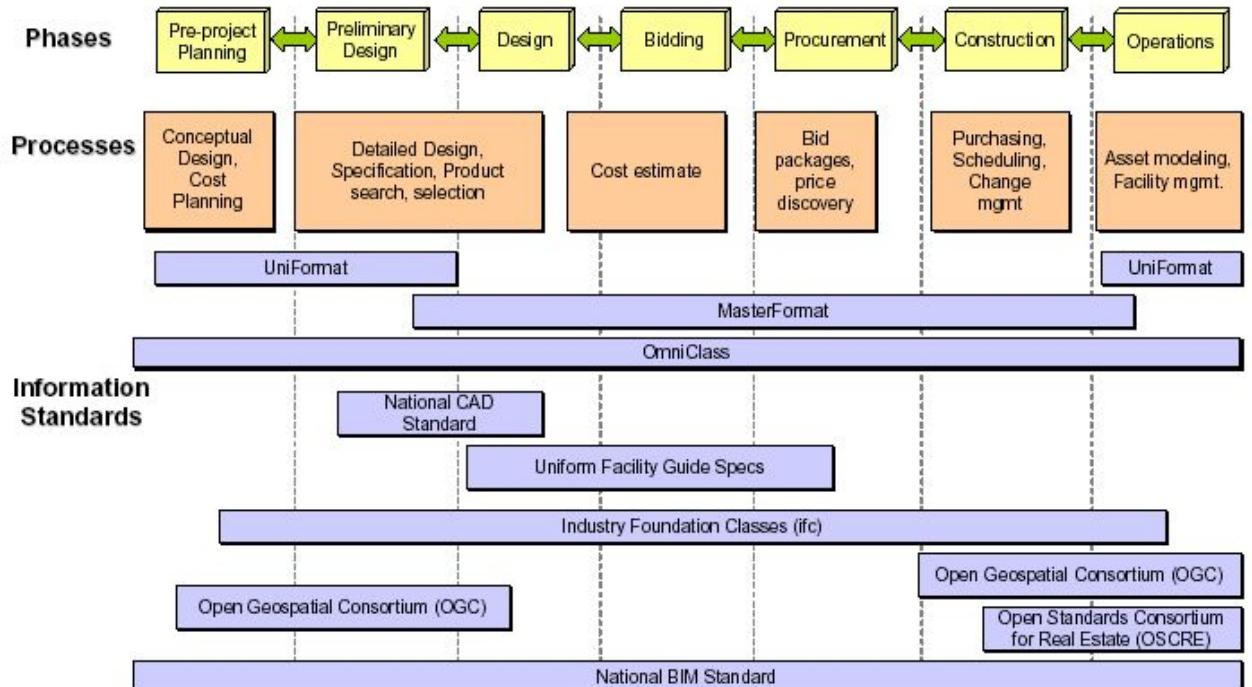
International Open Standard = IFC model

CSI Formats and Building Information Modeling



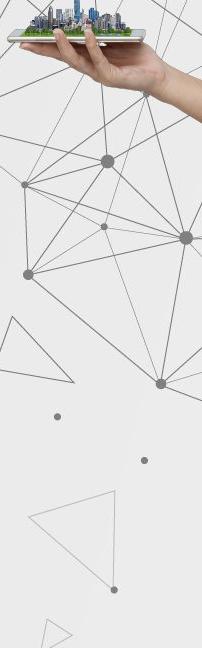
Roger J Grant
Director Technical Services and Development,
The Construction Specifications Institute

North American Information Standards



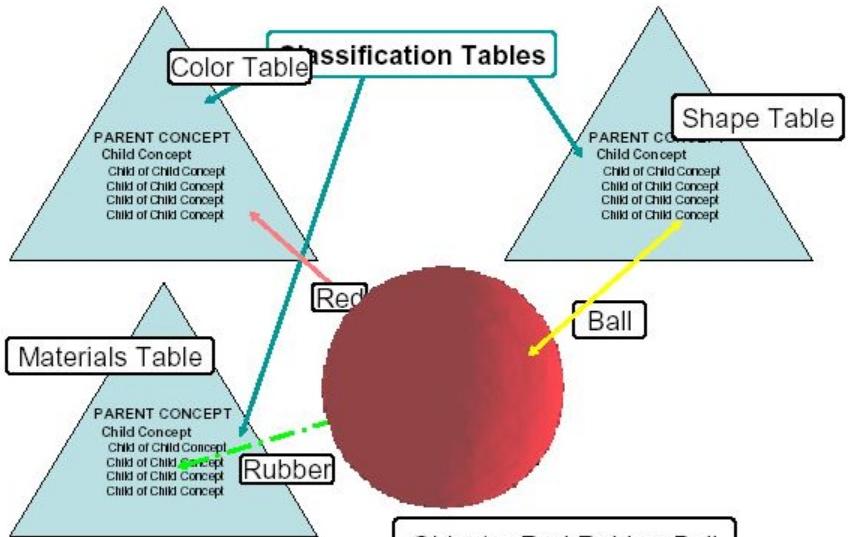
The Construction
Specifications Institute

October 2006





Faceted Classification



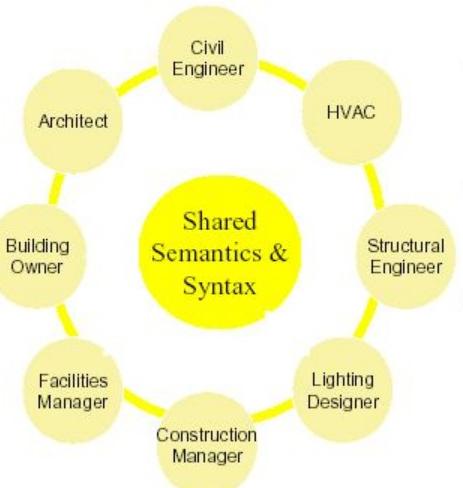
The Construction
Specifications Institute

October 2008

12

Bi-directional Information Flow and Cross-referencing

Agree on Semantics and Syntax



- Participants can communicate using a common language
- Any participant can communicate with any other participant
- Facilitates high performance teams



The Construction
Specifications Institute

October 2006

22



Info-Centric Organization

Framework for Integrated Decision-Making

Essence of this *IT-Enabled* Enterprise Framework:

- Moving away from building-centric and project focus
- Moving to a portfolio-based, business process linked to strategic outcomes
- Continuous horizontal flow across the organization
- Break down of the traditional structure of professional and trade disciplines and traditional stove piped software development
- IAI-IFCs and IFGs important because they enable the horizontal process flow through an open architecture and international standards



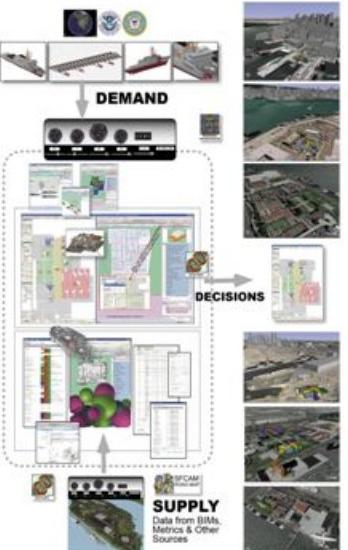


Capital Asset Management Portal

Access to Aggregated Database and Graphics

CAMP combines and displays portal tools and data views supporting Portfolio Management and Integrated Decision-Making and Value Chain.

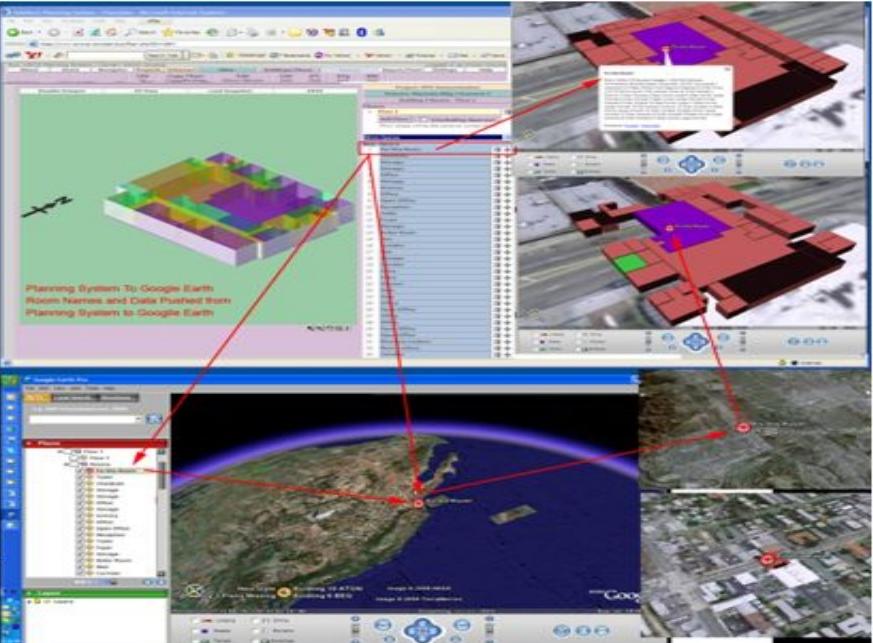
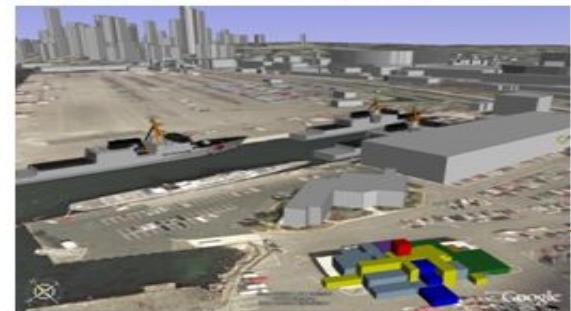
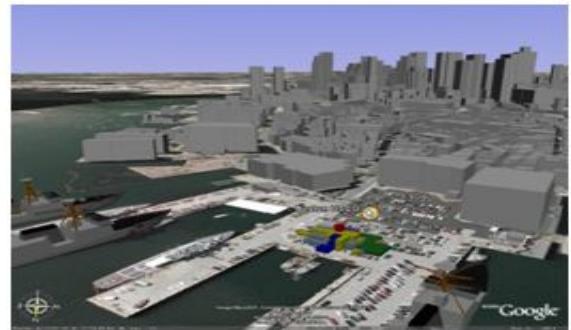
- Portfolio Management Links Supply and Demand Side of Scenario Based Mission Planning:
- Real Time Mission Readiness
- Scenario Based Business Case Development
- Automated Planning Documentation and Web-enabled Approval Process
- Value Chain as Web-enabled Workflow

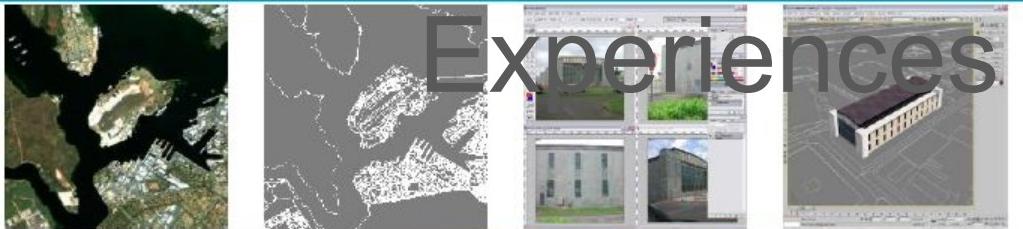




Combined BIM and GIS Workflows

Multiple Data Sources Accessed through CAMP





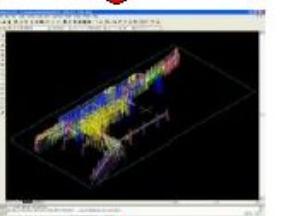
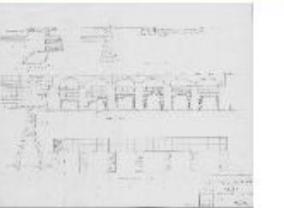
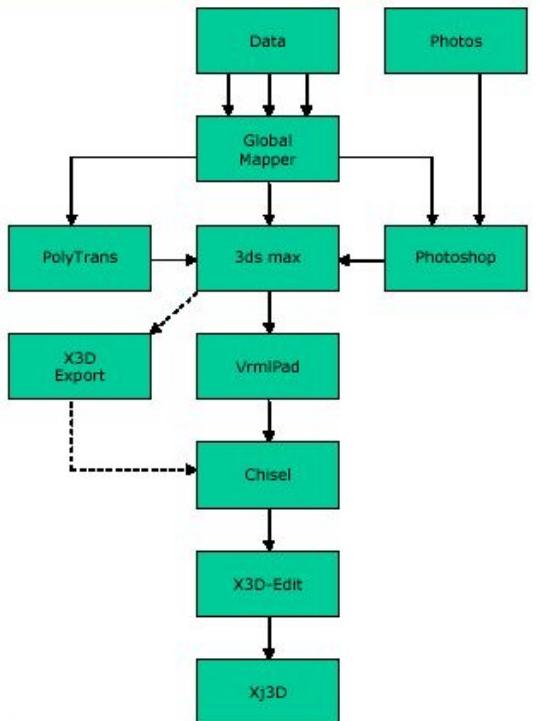
Experiences

Alex Viana
Naval Facilities Engineering Command
Washington Navy Yard, DC

- This presentation describes a step by step processes utilized to produce virtual 3D waterfront facility models of the Navy's built environment from paper drawings, existing 2D CAD files, and other geospatial data sets. The facility models have been created in open source, ISO-based standards format for 3D web graphics.



3D Model Production Process





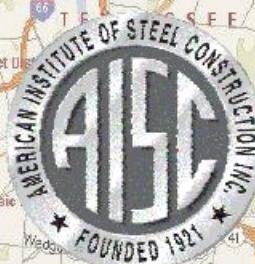
NAVFAC
Naval Facilities Engineering Command
Engineering Service Center

Virtual Earth Viewer for Navy Waterfront Facilities

The screenshot shows a 3D rendering of a cylindrical industrial component, identified as a Magnetometer Support Device (MSD). The interface includes a sidebar with navigation links like 'VIEWPOINTS' and 'Engineering Data'. A large red arrow points from the 3D model towards a callout box labeled 'Design Details', which contains a technical drawing of the MSD's internal structure. Another red arrow points from the 3D model towards a callout box labeled 'Vendor Information', which displays a document with vendor details. A third red arrow points from the 3D model towards a callout box labeled 'Inspection Reports', which shows a document titled 'Magnetometer Support Device (MSD)' with sections for 'Status' and 'Photos'. At the bottom, a 'Configuration Item #5' section is visible with status indicators: '1110_NSD2018' (Green), '(1) Under way' (Yellow), and 'Project Completed Phase' (Green).

THE ROAD TO PRODUCTIVITY

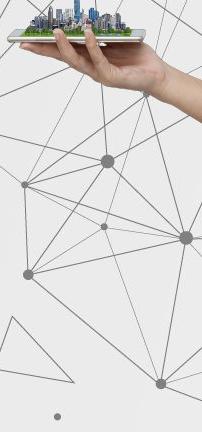
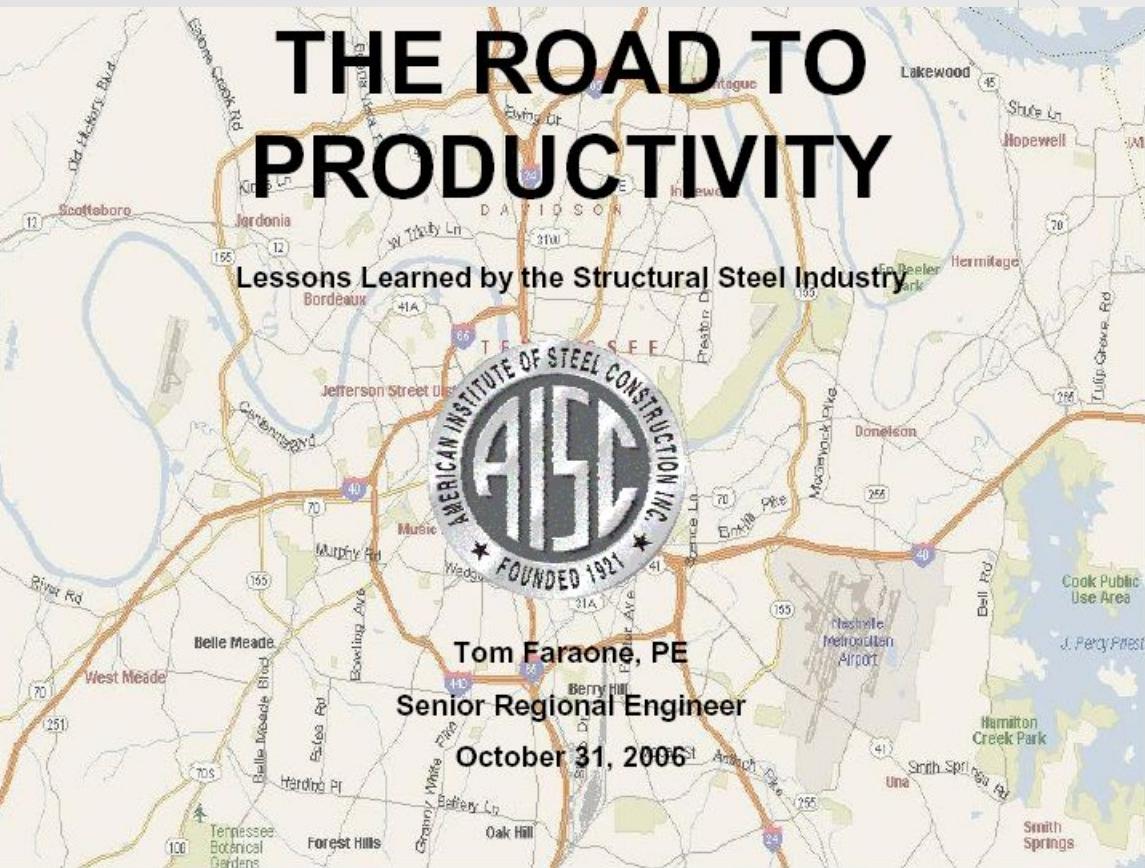
Lessons Learned by the Structural Steel Industry



Tom Faraone, PE

Senior Regional Engineer

October 31, 2006



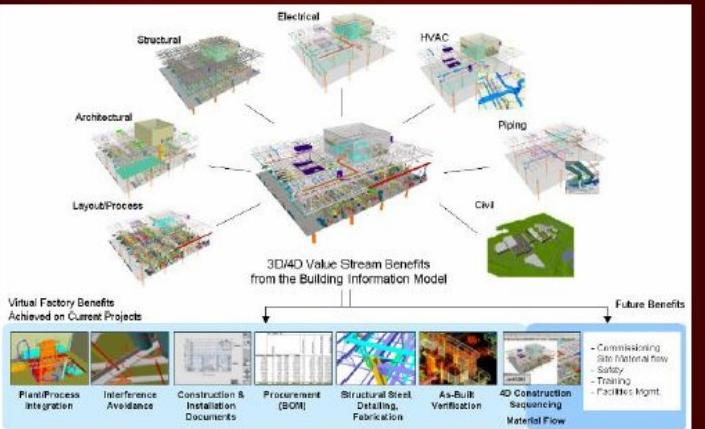


Roadmap

12 man-hours/ton

M Roadmap

And then came BIM...



Lessons Learned from the Structural Steel Industry



TODAY



Today .5 man-hours/ton

1/3 the energy

A BIM Roadmap

Wayne L Morse U.S. Courthouse Eugene, OR



“Fastest GSA project ever.”
“Change orders were less than 3%.”

Lessons Learned from the Structural Steel Industry

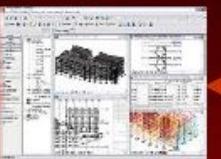


A BIM Roadmap

ARCHITECTURAL



STRUCTURAL



HVAC



CLADDING



IFC

IFC

IFC

INCREASED PRODUCTIVITY EQUALS

Greater Value

Lower Costs

Accelerated Schedules

Safer Construction

Building Information Modeling horizontally integrates all building systems into a single, consistent design model allowing coordination of components and elimination of interferences.

Lessons Learned from the Structural Steel Industry

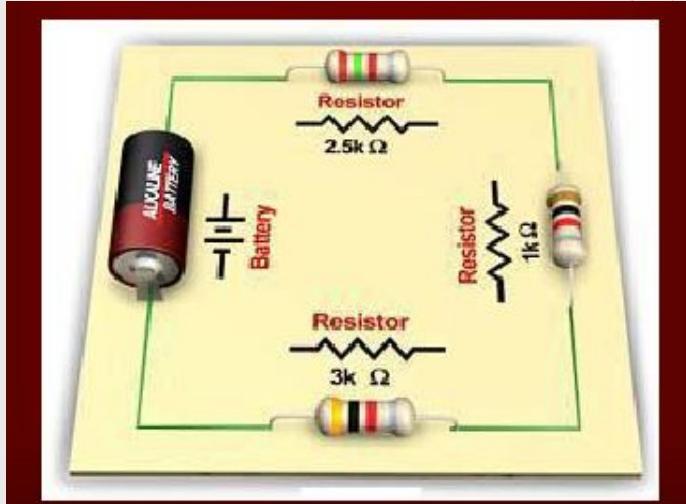
BIM is merely an enabler

it may institutionalize process changes,
it does not drive change;

People propel organizational changes (Spitzer, 1996).

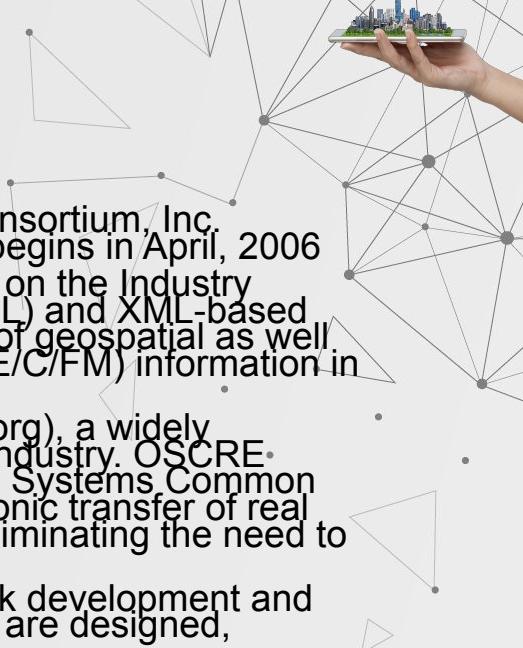
Institutional barriers and inertia yield slowly to data sharing and system interoperability initiatives, even when it is obvious that data sharing and interoperability will save time, money and lives.

RESISTANCES:



Coordination among standards organizations interoperability between geospatial and BIM environments

- The CAD-GIS Interoperability Working Group in the Open Geospatial Consortium, Inc. (OGC(R)) OGC Web Services Interoperability Initiative (OWS-4), which begins in April, 2006
- International Alliance for Interoperability (IAI) advancing BIM work based on the Industry Foundation Class (IFC) standard, and eXtensible Markup Language (XML) and XML-based GML expressions of IFC are being developed to improve the integration of geospatial as well as architecture, engineering, construction and facilities management (A/E/C/FM) information in a single model.
- The Open Standards Consortium for Real Estate (OSCRE) (www.oscre.org), a widely recognized e-commerce standards group working within the real estate industry. OSCRE works closely with an international organization, the Property Information Systems Common Exchange Standard (PISCES). The OSCRE standard enables the electronic transfer of real property information directly from one system into another, reducing or eliminating the need to send hardcopy and re-enter data manually.
- FIATECH (www.fiatech.org), a non-profit consortium focused on fast-track development and deployment of technologies to improve how capital projects and facilities are designed, engineered, built and maintained.
- OGC also has a formal collaborative agreement with the U.S. National Institute of Building Sciences (NIBS), which administers IAI for North America. Discussions with other IAI chapters are underway.



Emerging Technology Summit

ETS - IV: Convergence: CAD / GIS / 3D / BIM

Start: 2007-03-21 08:00 End: 2007-03-23 17:00

- Details: Presented by the Open Geospatial Consortium and the Geospatial Information & Technology Association
- This ETS will focus on those standards and the benefits of Building Information Models (BIM), including:
 - * Designers and engineers will have lower costs and risks
 - * First responders will be able to respond more quickly
 - * Efficient monitoring will lower operating costs
 - * Better views of facilities will lead to better decisions
 - * Realtors, appraisers, and bankers will save money
 - * Regulations compliance costs will be lower
 - * Subcontractors' costs and risks will be reduced
- This Emerging Technology Summit and Workshop will be held at the Melrose Hotel
- Melrose Hotel
 - 2430 Pennsylvania Avenue, NW
 - Washington, DC 20037
 - Tel: 202 955 6400
- [Driving Directions and Map](#)
- Check back soon for more details and online registration!



Elements of the Project Charter

- Spatial awareness across AEC lifecycle is defined to be critical requirement
 - Inside and outside of a building
- Identify and define requirements where convergence between geospatial and building information across the building lifecycle is needed
- Review and where possible adapt geospatial standards-based workflows that meet requirements, save time and effort where convergence exists
- Identify existing standards that are ready for immediate testing for candidate status



BIM-GIS Project Focus

- How can BIM applications and information seamlessly interact with geospatial information during across the lifecycle process to address requirements related to site conditions and surroundings?
- How can BIM and geospatial applications be used to communicate campus-wide information requirements for lifecycle facility management and operations?
- How can 3-D CAD and geospatial portrayal services facilitate modeling in campus-wide and facility perspectives for as-is BIM model and further extension for planning or design activities?



BIM to GIS Integration Issues

- BIM is MUCH richer in detail than a GIS database
- GIS has only recently become fully 3-D
- Design BIM contains all the information needed to construct a building, but not to manage it
 - Space polygons
 - Occupant information
 - Asset details (make, model, etc.)
 - Equipment maintenance data
- Some of the missing data can be supplied by COBie
- GIS database and BIM will require network capabilities to share information



Fundamental Differences Between BIM and GIS

BIM (IFC)

- Highly standardized structure
- Parametric – highly structured
- File based
- File based exchange
- Inferior data exchange between COTS products
- Small number of users
- Thick client

GIS

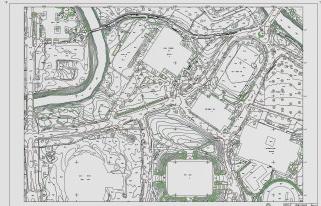
- User defined structures
- Parametric – loosely structured
- Server based - relational database
- File and web services for exchange
- Maximum integration flexibility
- Large numbers of users
- Thick and thin clients



Potential Integrated CADD/BIM/GIS Data Workflow



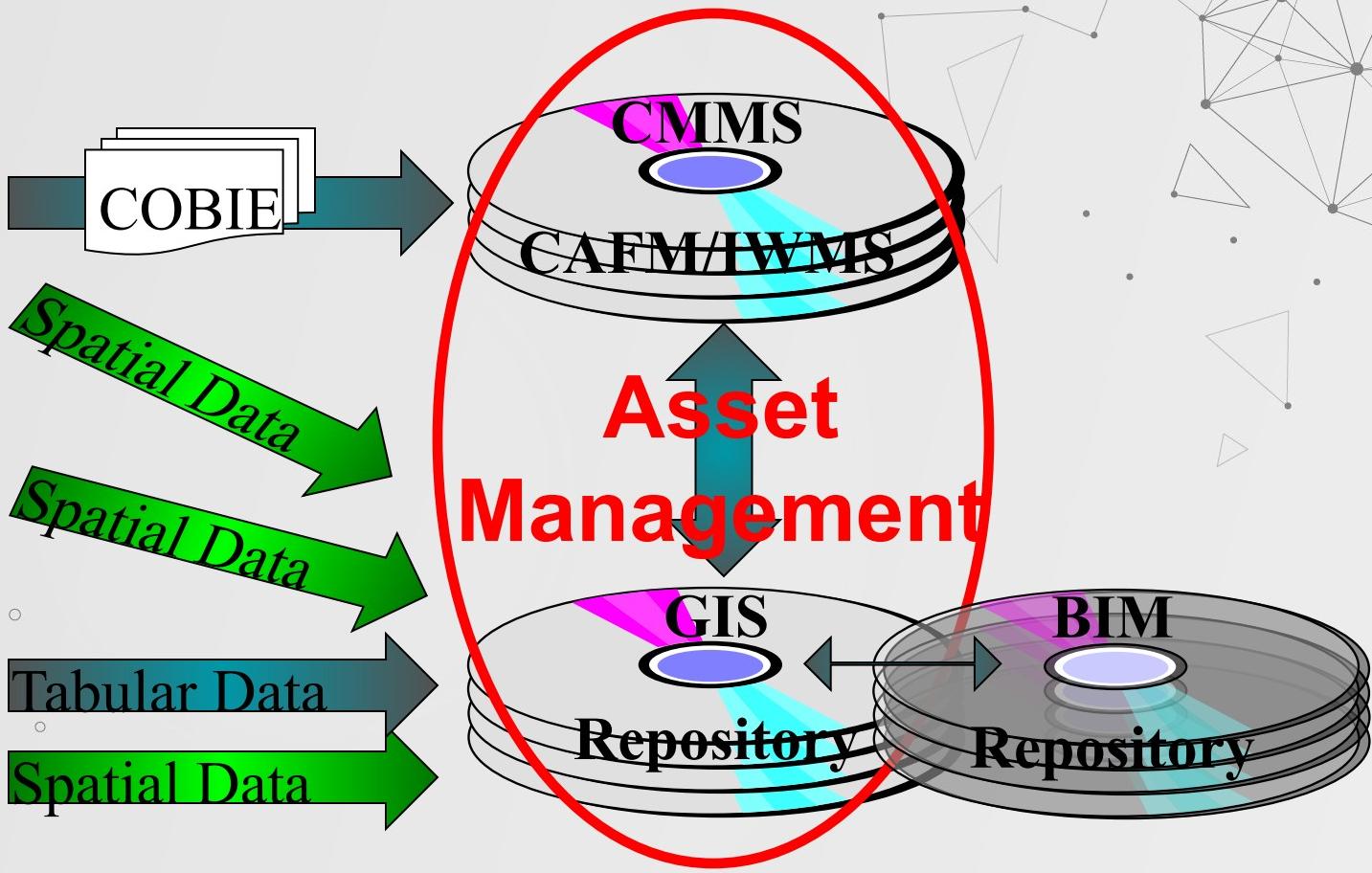
BIM Data



CADD Data

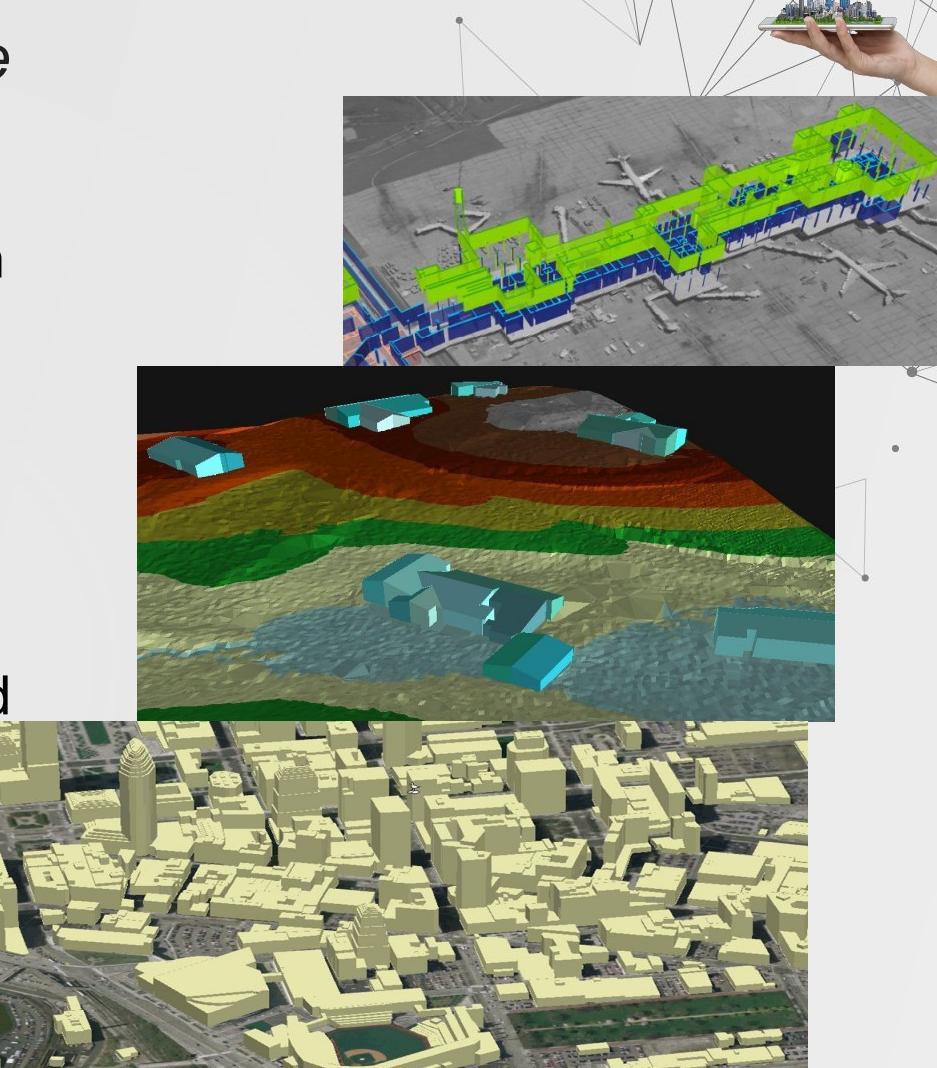


GIS Data

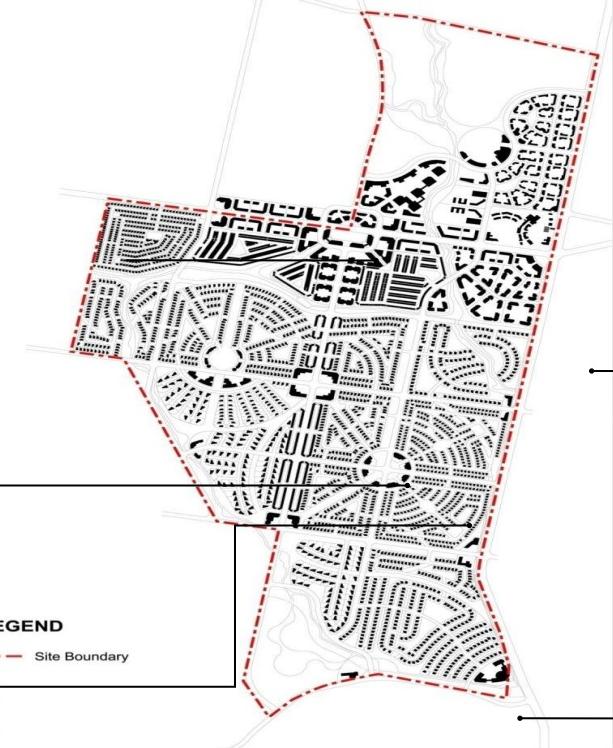


BIM – GIS Information Exchange Project

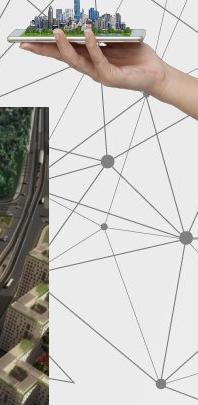
- BIM and GIS both play key roles in a facility lifecycle
- Both systems need to exchange data yet both serve as the repository for key data elements
- This Project will provide the basis for an information relationship between the two environments and their underlying databases



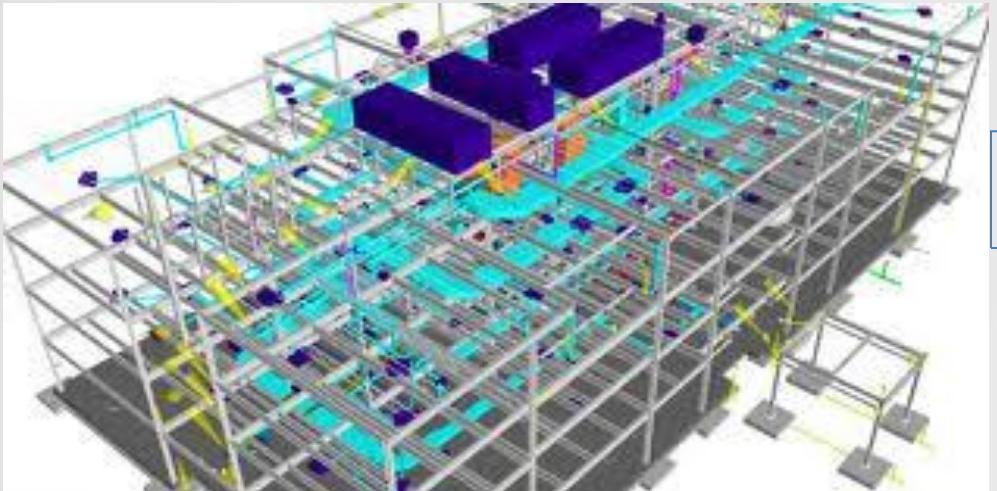
Urban design to Architecture



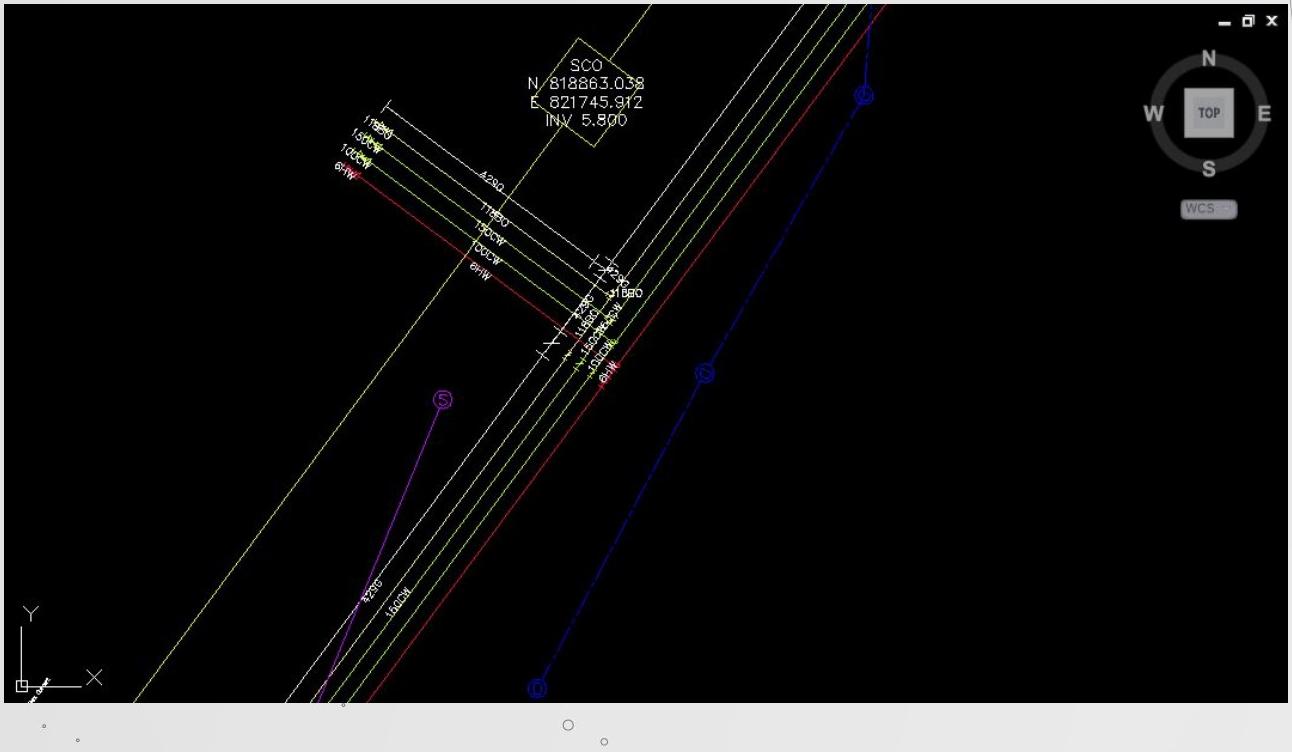
Engineering Schemes (simplified)



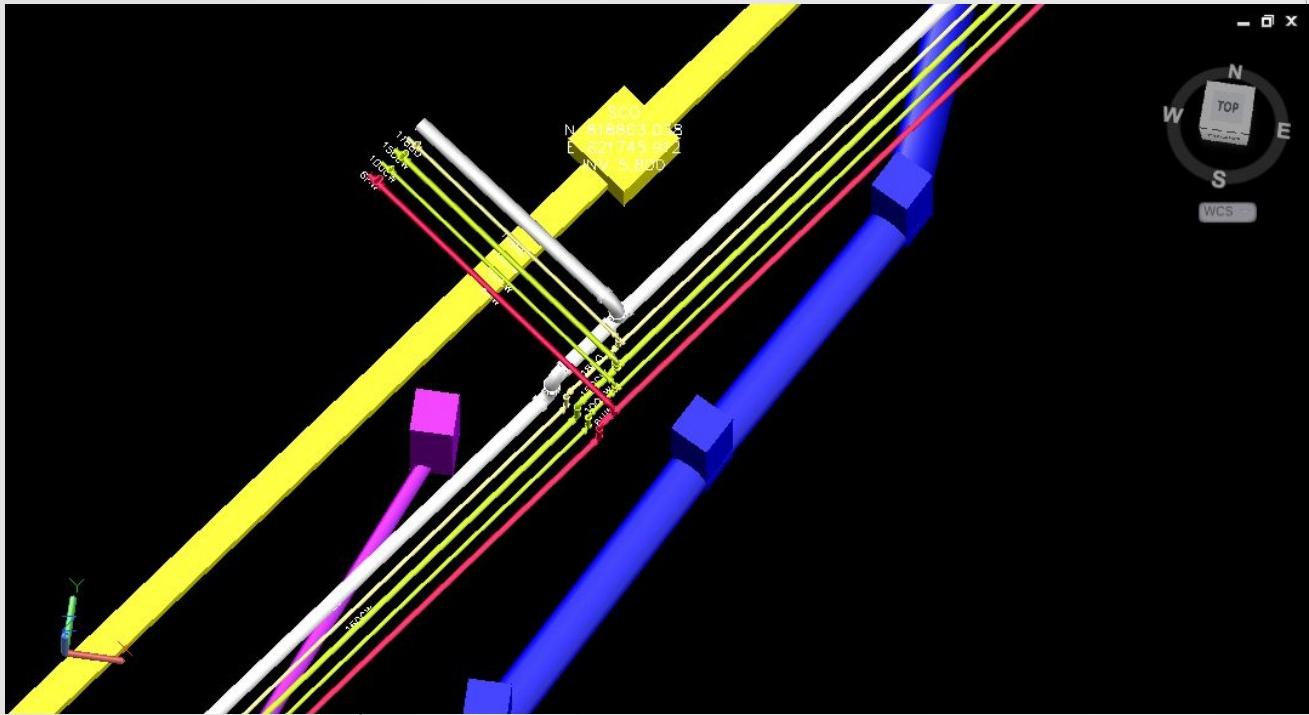
Construction



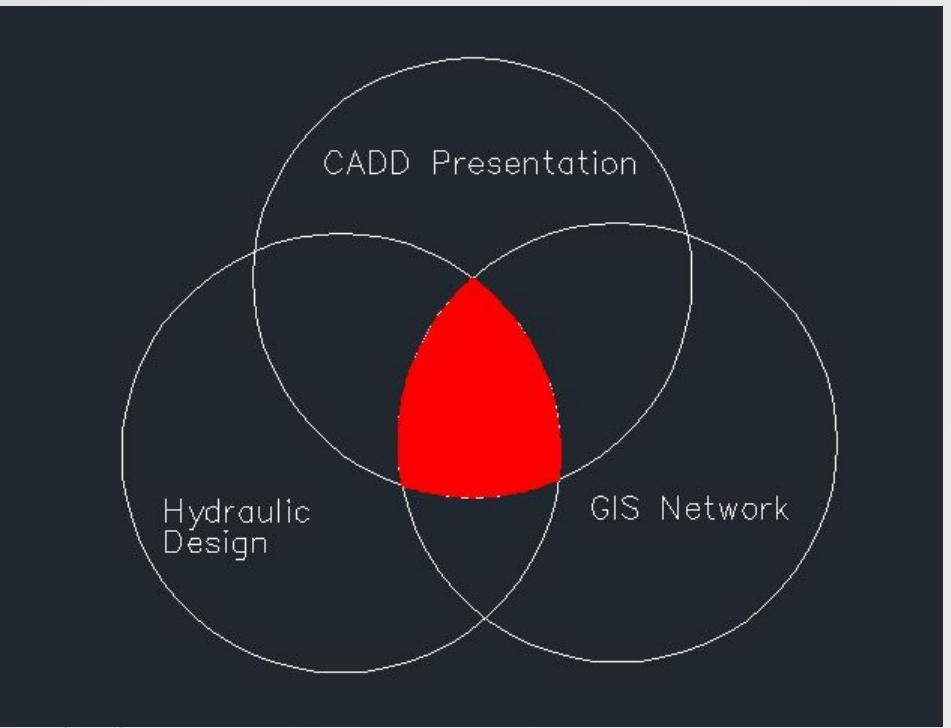
Underground Utilities - Plan View



Underground Utilities - 3D View



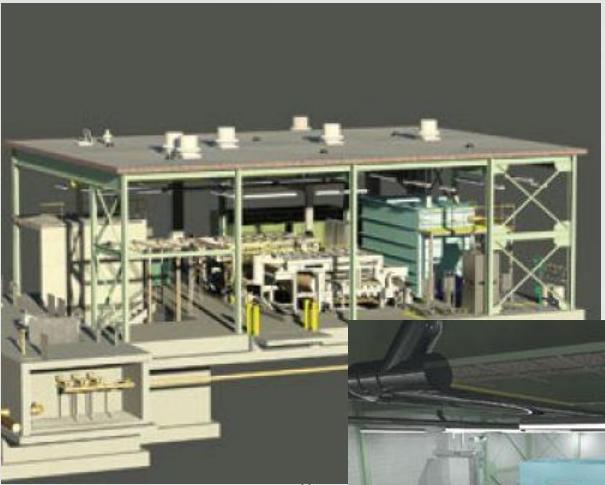
One Drainage Network Model for All



Lollipop Model by C K Ng, 1998



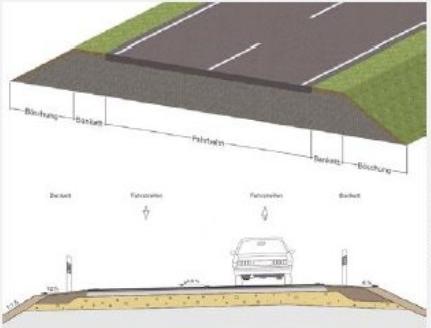
Station/Process Plant



Road/Bridge



Infrastructure Scope between GIS and BIM Standards – 2



Road Construction Sectioning



Road Construction - Bridges



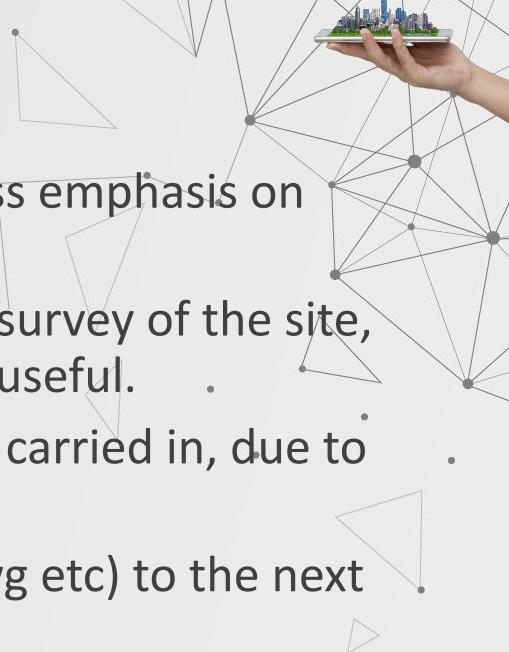
Road Construction Detailing

clearly BIM scope

- big scale
 - engineering CRS
 - mainly volumetric
 - longitudinal structure
 - element composition
 - open – bSI / TC59 ?
 - open – IFC ?

Key points of non coordinations

- At urban planning stage, site plans are created with very less emphasis on ground level accuracy.
- At Detailed engineering level, there will be need to precise survey of the site, where the plans created in the previous stage are no more useful.
- At the construction stage inputs from earlier stages are not carried in, due to lack of unified coordination.
- In most cases, spatial data is transferred as files (shape, dwg etc) to the next level.

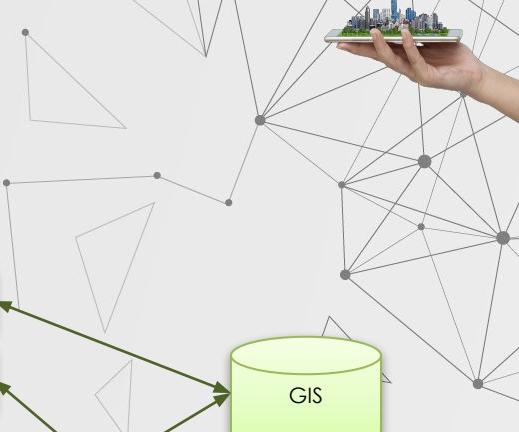
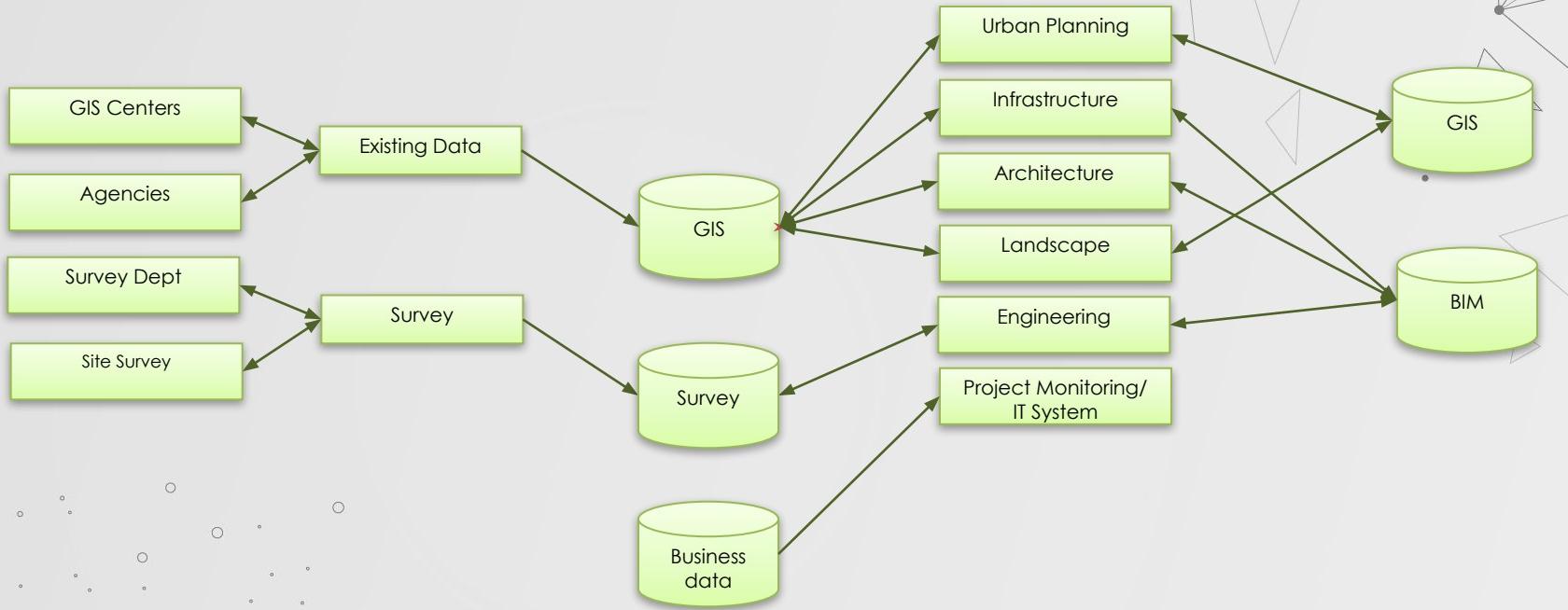


Reasons

- Isolated business goals and targets.
- Lack of understanding of others businesses.
- Little understanding of the coordination perspective of technologies (using technology as coordination tool)
- When to do what (when to bring in technology)



Result - Silos model



Business Model for Integration

- Technologists and business leaders are forced to change and bring in better methods to survive in the business and be competitive.
- Michael E porters five competitive forces theory simplifies the reasons for organisations to be nimble.



Stake holders & roles

- Technology and domain experts should work together to evolve a solution.
- Design standards and data standards needs to be in place.
- A seamless data models (simple to complex) needs to be developed.

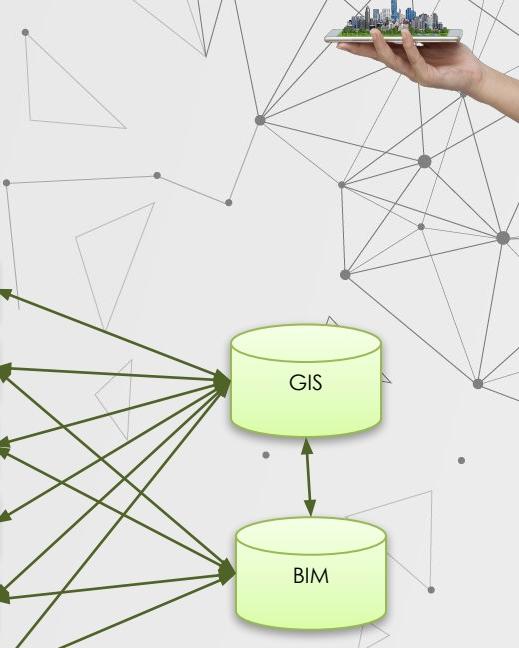
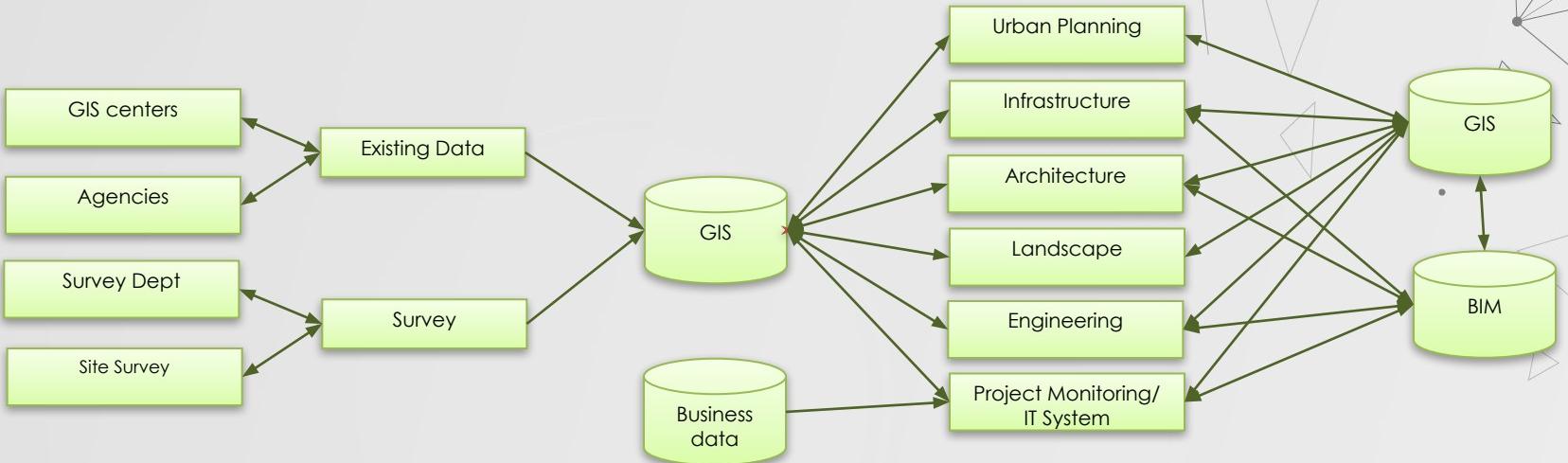


Leaders

Domain Experts

Technologists

Integrated model



Key Technology changes

- Real time design and modeling – 3D GIS & BIM
- Unified data models - CityGML
- Intelligent data collection – scanners, sensors
- Extensive knowledge and analytics - GioBI

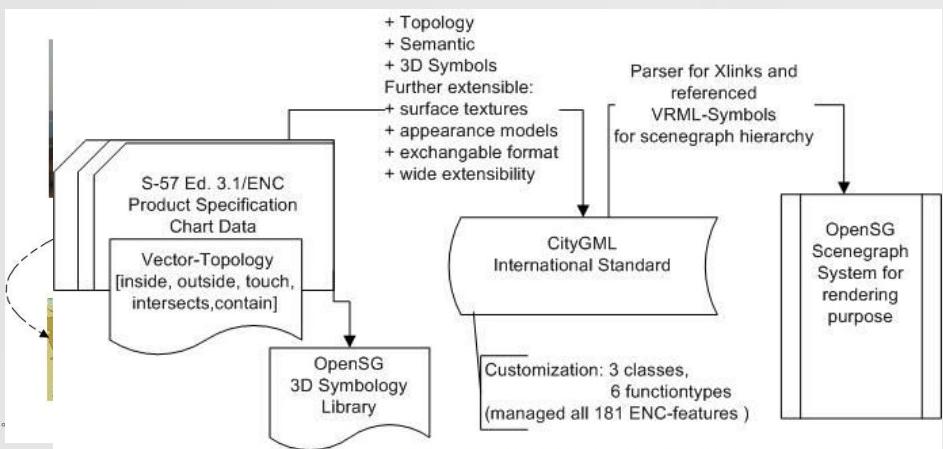


CityGML and AR

search for "augmented reality" citygml



- CityGML
 - Application scheme of GML
 - Structure for thematic modeling, semantic descriptions, appearance storage of 3D geometries and features
 - Aligned with IFCs and BIM standards
- Example: Extension of Electronic Nautical Charts for 3D interactive Visualization via CityGML. Haase and Koch, 2010





Real time design and

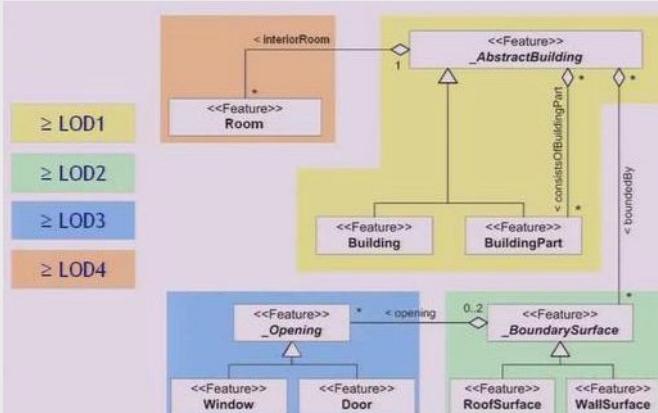
Design activity will become more interactive, developers will get to know the cost, sustainability and project schedule (with 95% accuracy) before the project starts. They would exactly the following.

- Capital Investment
- Regulatory adherence
- Project time line
- Environmental sustainability
- Design
- Contractors
- Logistics



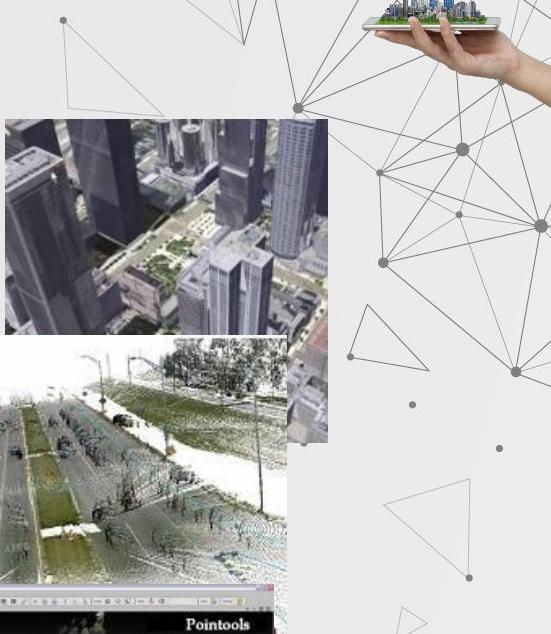
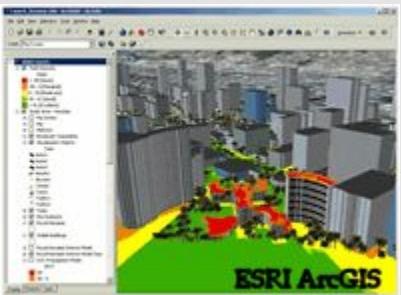
Unified data models -

- CityGML plays a key role in making GIS & BIM to work together.
- Initiative of OGC to give a semantic city model (since 2005) is the first step to integrate 3D GIS models into upstream activities.
- BIM follows IFC standards which will also handle schedule, cost estimates, along with walls, roofs, floors, doors and other objects of building inventory.



Why is CityGML necessary?

- Increasing interest in 3D
- Research shown a definite need for 3D
- Standards led approach



Web Services

- CityGML based on GML3 – combines with other OGC standards
 - WFS, CS-W, WCTS and WPS especially
 - Examples
 - OGC Web Services – 4 (OWS-4) Testbed – showed how cityGML/IFC 3D data can be used in disaster management
 - Statewide 3D SDI with cityGML – NRW. Noise modelling
 - SDI Berlin – city urban planning, civic participation etc
 - Heidelberg



Software supporting cityGML

- 3D Geo **LandXplorer** CityGML Viewer (free)
- University of Bonn: **Aristoteles** Viewer (free)
- Snowflake Software: **Go Loader & Publisher WFS**
- Interactive Instruments: WFS
- **Oracle 11g**: 3D data types and CityGML loader
- Tech. University of Berlin: **Oracle schema/loader/updater**
- Safe Software **FME** reader (writer in development)
- ESRI – ArcGIS 9.3 – **Interoperability Extension**
- **Bentley**: Work in progress
- • **Autodesk**: Work in progress



Extending CityGML

- 2 methods for extending basic functionality of cityGML
 - Generic Objects/Attributes
 - Application Domain Extensions
- Generics – allow extensions during runtime i.e. no additions to XML schema
 - Classes GenericCityObject & GenericAttribute
 - Only used for features not in cityGML model
 - Issues
 - May occur arbitrarily – no formal specification, reduces semantic interoperability
 - Naming conflicts may occur



Application Domain Extensions

- CityGML – Base information model. Specific applications need extra information. E.g. Environmental simulations, Utility networks, etc
- Types of domain extension
 - Extend existing cityGML feature types
 - Extra spatial/non spatial attributes
 - Extra relations/associations
 - Definition of new feature types
 - Preferably based on cityGML base class CityObject
 - Each ADE requires its own XML schema definition





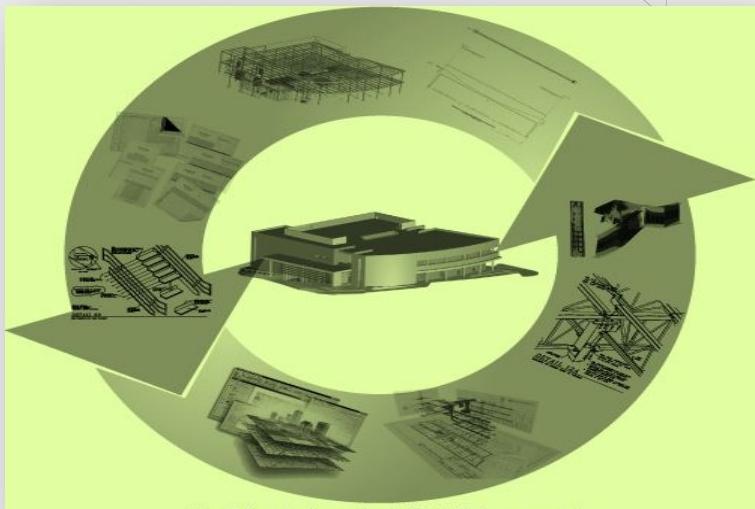
Large models:
55 000 detailed buildings

Image: Reality maps, Berlin 3D



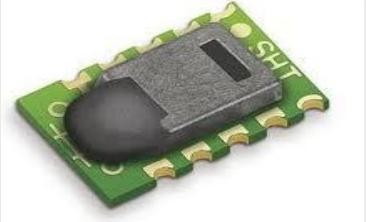


- GIS bring in **How to complement** spatial analysis of location and surrounding.
- GIS forms the base of the next level.
- BIM is good for Specific construction site analysis (LOD 4), design, sharing and project management.



Intelligent data collection-

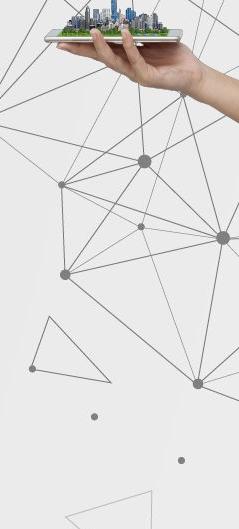
- Geo enabled Sensors play a vital roles in developing and managing smart cities.
- KPIs like, traffic, vehicular pollution, industrial pollution, energy consumption and resulting carbon foot prints are monitored using various types of sensors.



Geo Business Alalytics -

- Display, query and analysis of large data is always a challenge for GIS users.
- GeoBI would help to query analyze huge volumes of data in very short time.
- GeoBI can also seamlessly work through number of sources and provide.





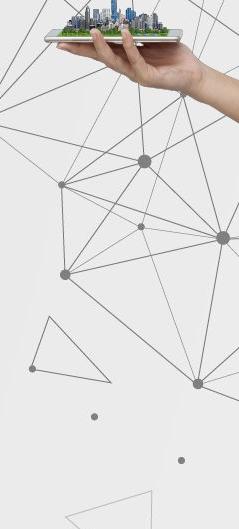
What is OpenStreetMap?

- Geographic data
 - For driving, riding, walking, boating, skiing, hiking, anything
- Free
 - Currently CC-BY-SA, moving to ODBL
- Wiki-like editing



<http://www.osm.org>





Available on many devices



OffMaps on iPhone



Garmin PNDs



Garmin GPSs



AndNav2 on Android



GPSMid on J2ME

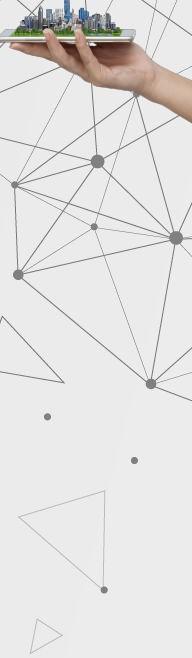


Gosmore on Windows Mobile

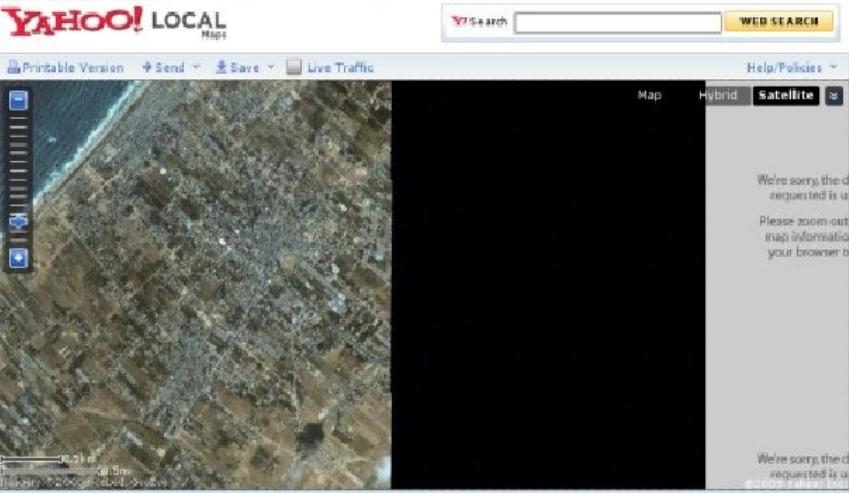
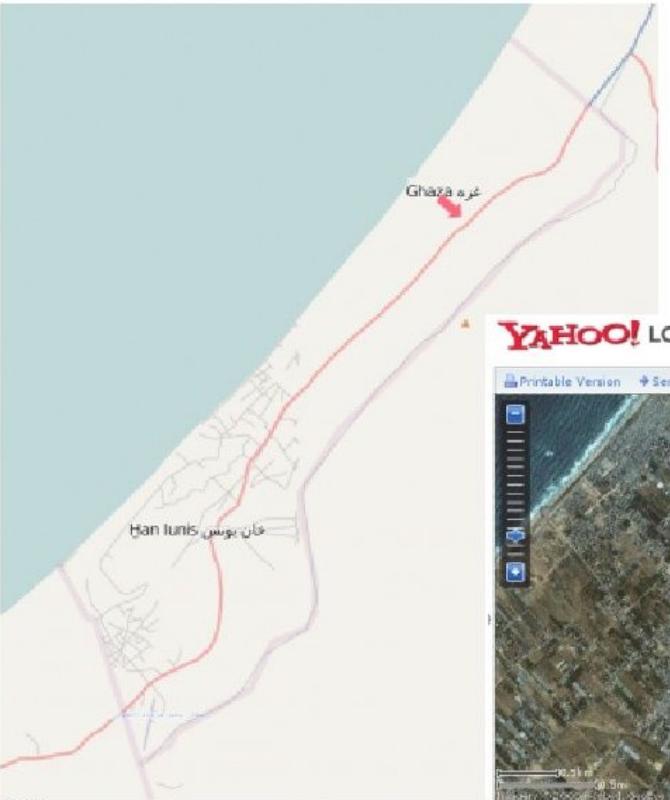


MaemoMapper on Nokia Maemo





OpenStreetMap Gaza Project

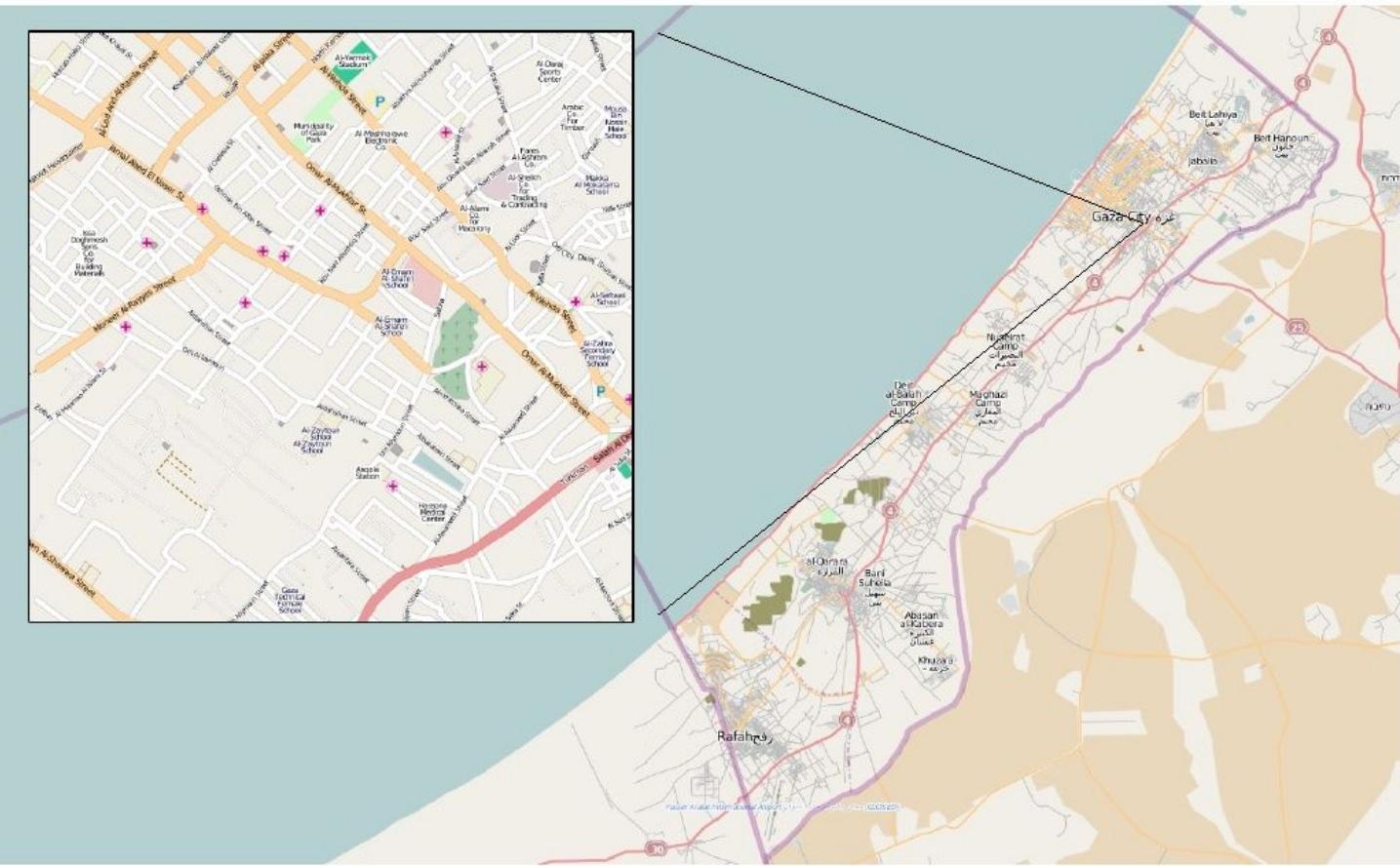


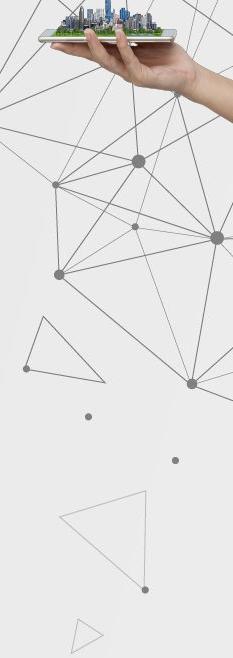
Jan 2009: Mikel Maron announces OpenStreetMap Gaza Project

Feb 2009: Mapping begins with purchased aerial imagery (~ \$6000)



Gaza Strip today





Use and Media Coverage

Uses of OpenStreetMap data by crisis responders

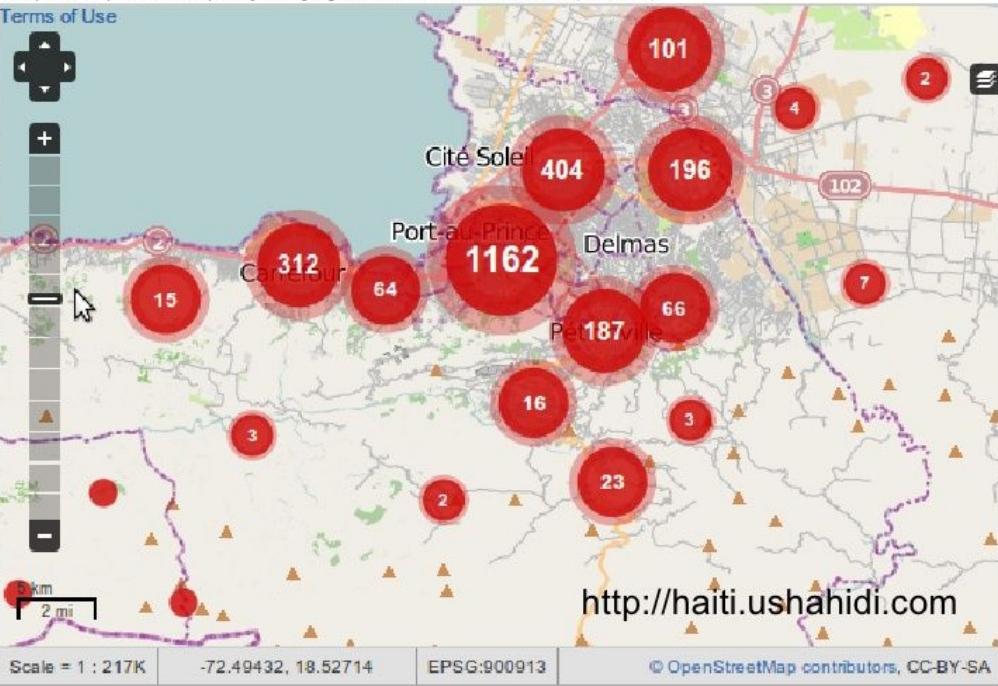
People on-the-ground in Haiti (and related organisations) are using (or used) our maps :

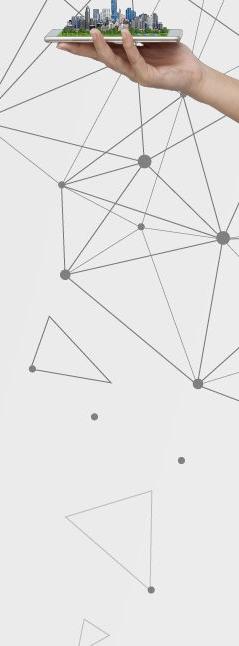
- Thanks message [from Colombian Mission in Haiti](#). (2010-02-10)
- "This is where OpenStreetMap is a godsend" in [How to Deploy Long-Distance WIFI in Haiti](#) (2010-02-10) by [inveneo](#), a NGO whose mission is connecting those who need it most, on how they were able to bring high-speed Internet access - critical communication capacity - to eleven relief agency locations with minimal equipment and installation time.
- On 13/01/2010 [IHTACA](#) and [WFP](#) published their damage assessment of Port-au-Prince using OSM road data.
 - Special session on mapping the disaster during the Haiti Emergency at the GI4DM 2010 Conference [See subpage GI4DM 2010](#)
- [OpenStreetMap renderings on Garmin GPS receivers by Colombian search and rescue operators](#). "Many thanks Freddy. Very timely maps of Haiti that sent me to the Garmin. I went down and installed the GPS in our search and rescue teams. OSM undoubtedly be a great help to our response teams, especially those going to move to rural areas." via [ouruunH](#) (2010-01-15)
- Fairfax County Urban Search & Rescue Team Using
- Unitar / UNOSAT use OpenStreetMap street data in t
- GDACS [use OSM street data in their reports](#)
- JRC [use OSM street data in their report](#)
 - "I'm told OSM is on the big monitors at SOUTHCOM."
 - On 18/01/2010 [IHTACA](#) and [WFP](#) released maps
 - NOAA's Environmental Response Management Appl
 - The Food and Agriculture Organization (FAO) (<http://fenix.fao.org:8080/fenix-web/org.fao.fenix.we>)
 - The Office for the Coordination of Humanitarian Affairs Wiki as a resource (Social Media Links category) for
 - Secretary of State Hillary Clinton, Remarks on Internat
 - Kjeld Jensen, Red Cross (IFRC): "Hello guys, I just wa
- impressive. It has already saved me and my drive
- Again thanks a lot guys, we are really running fast here
- Jihad Abdalla from UNICEF (<http://groups.google.com/group/unicef-haiti>...Million thanks."

Other earthquake related websites using our maps :

- [Atlas](#) compiled by the Center for Interdisciplinary
- [flickr.com](#) - the massive photo sharing site switch
- <http://haiti.ushahidi.com/> - plotting "reports" from
- MapAction (<http://mapaction.org>) use OpenStreetMap
- Information Management & Mine Action Programs (
- World bank printed a giant poster for their SitRoom
- OpenStreetMap data is being shipped on drives to th

There are many alternative renderings/map views too.





Use and Media Coverage

Uses of OpenStreetMap data by crisis responders

People on-the-ground in Haiti (and related organisations) are using (or used) our maps :



Other earthquake related maps

- Atlas ([http://atlas.ushahidi.com](#)) compiled from various sources
- flickr.com ([http://flickr.com/search/?q=haiti](#)) - the Flickr community
- [http://haiti.ushahidi.com](#)
- MapAction ([http://mapaction.org/haiti](#))
- Information Management ([http://im.haiti.ushahidi.com](#))
- World bank printed ([http://www.worldbank.org/haiti](#))
- OpenStreetMap ([http://osm.org/haiti](#))

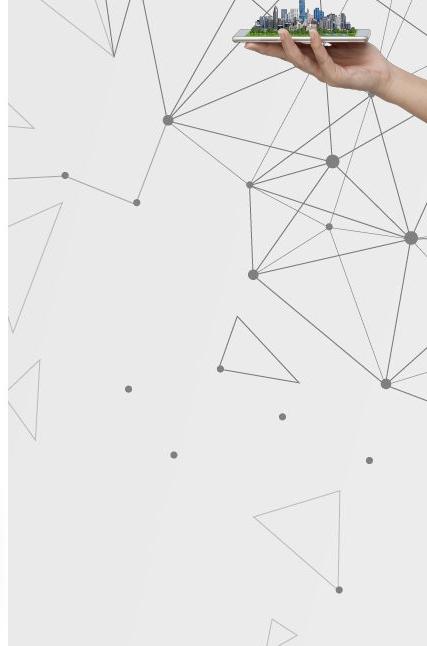
There are many alternative renderings/map views too.



An introduction to OpenStreetMap

"Hello guys, I just wanted to let you know that your work on improving the Haiti maps is really appreciated here. A few days ago I installed a version on my Garmin Oregon GPS and the result is impressive. It has already saved me and my driver from getting lost twice, and the alternative would have been long delays. In the coming days I will try to update our Red Cross relief GPS receivers with your map." - Kjeld Jensen, Red Cross (IFRC)

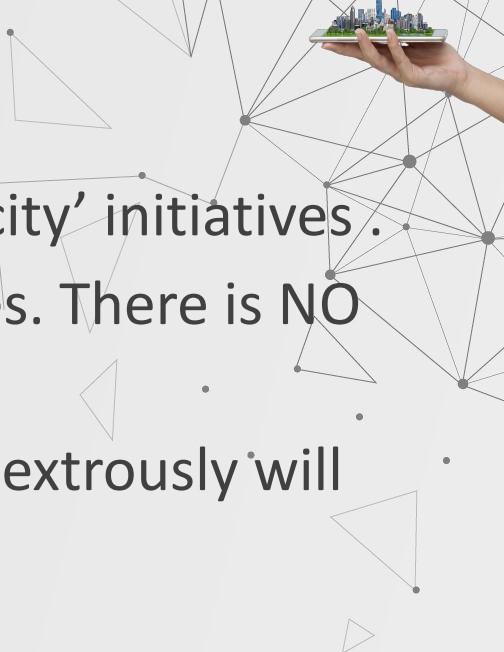






Conclusion

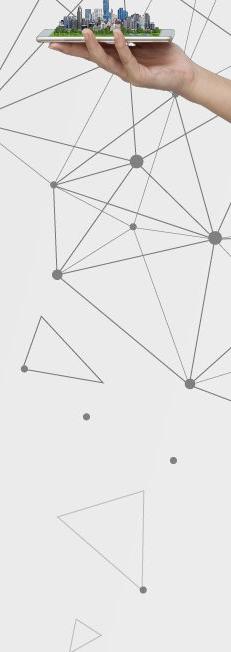
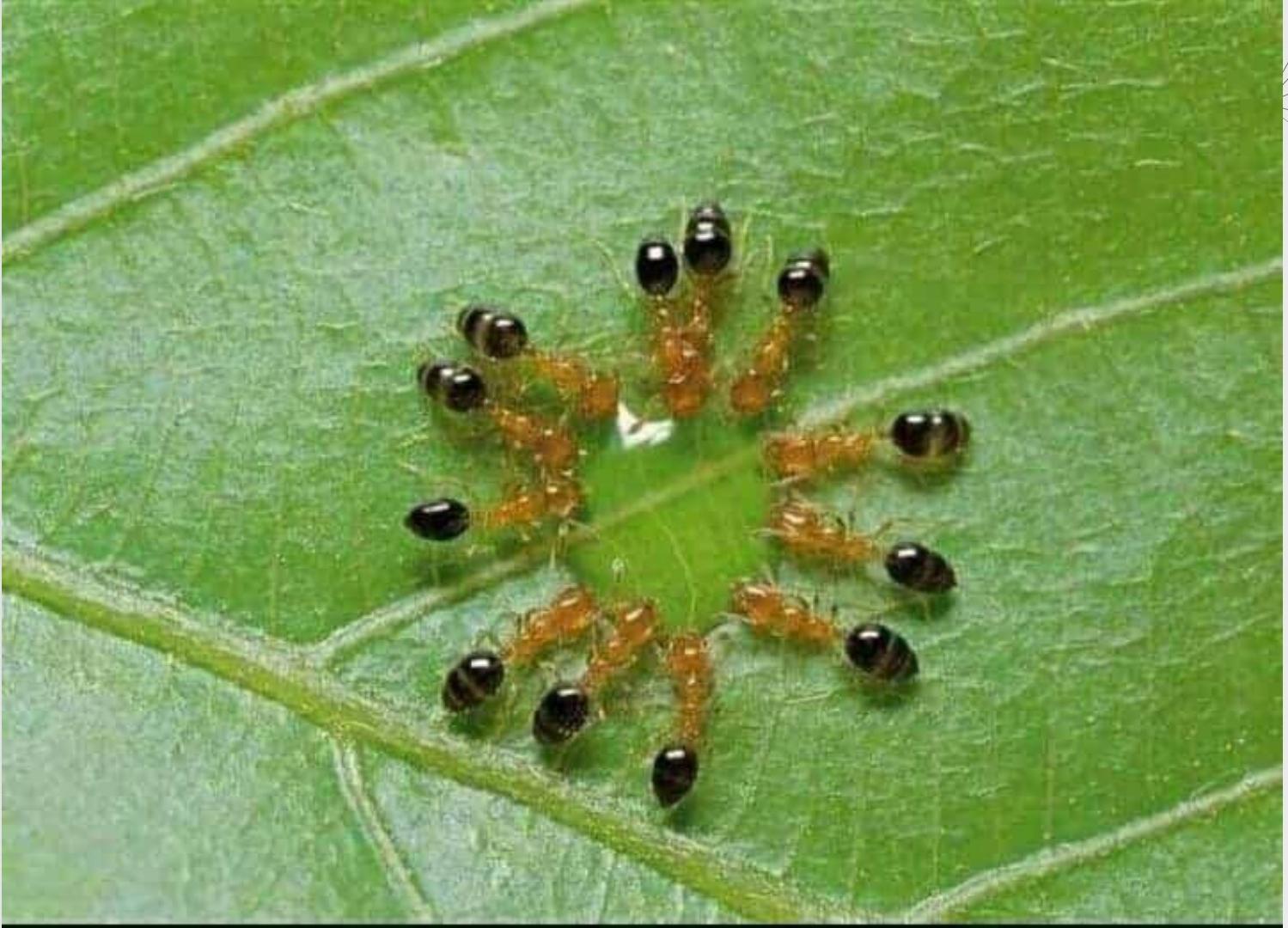
- Geospatial shall play a very vital role in future ‘smart city’ initiatives.
- If Sustainability is the way forward for future cities. There is NO way forward with Geospatial platforms in place
- Integration, ability to work with GIS & BIM ambidextrously will yield great results.





Examples Of Smart City

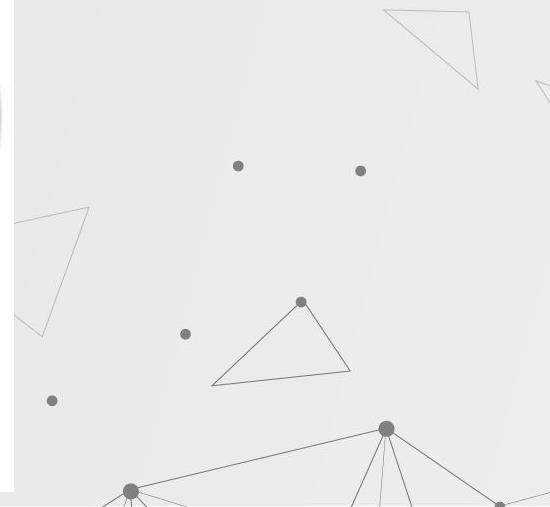
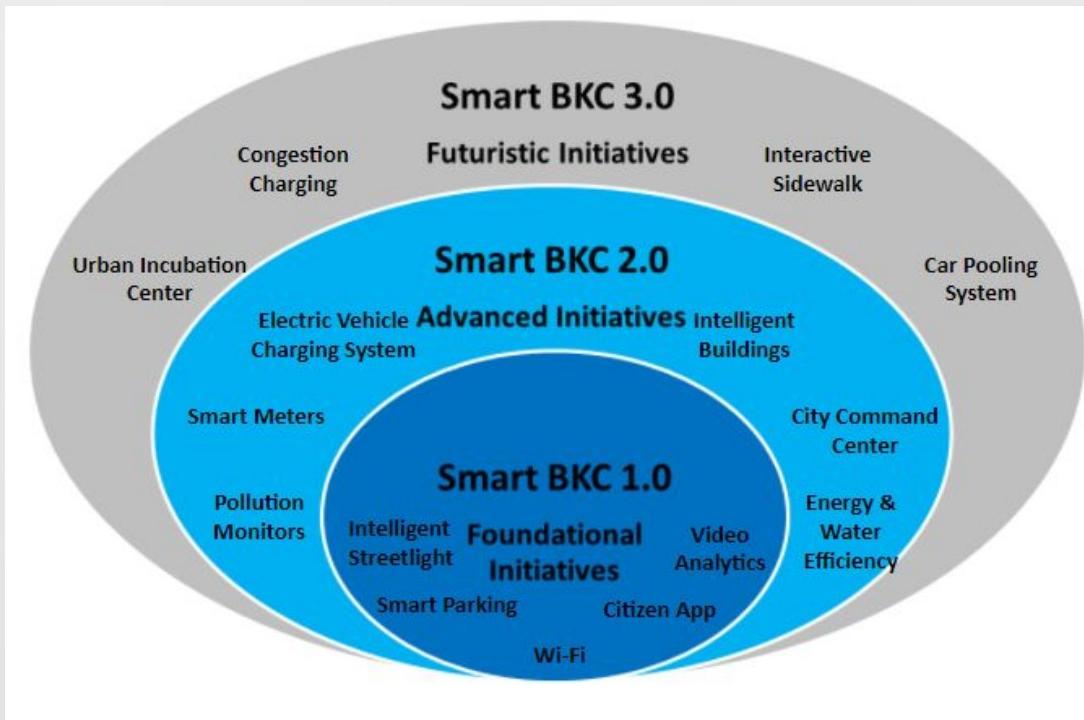






Smart BKC Plan- Phases

MMRDA has started its Smart City journey with focus on creating BKC as Intelligent Region and identified Top 5 solutions to create foundation for Smart BKC.





Technology evolution to a smart city

Smart

Integrated

Managed

Networked

Measured

Pervasive sensor networks throughout city

Node connections through low-cost communications

Real-time analysis and control of city systems

Integration of isolated systems and across cities

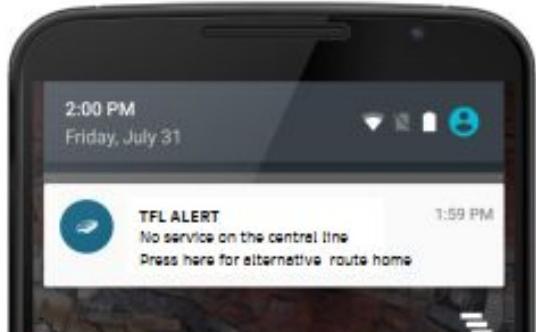
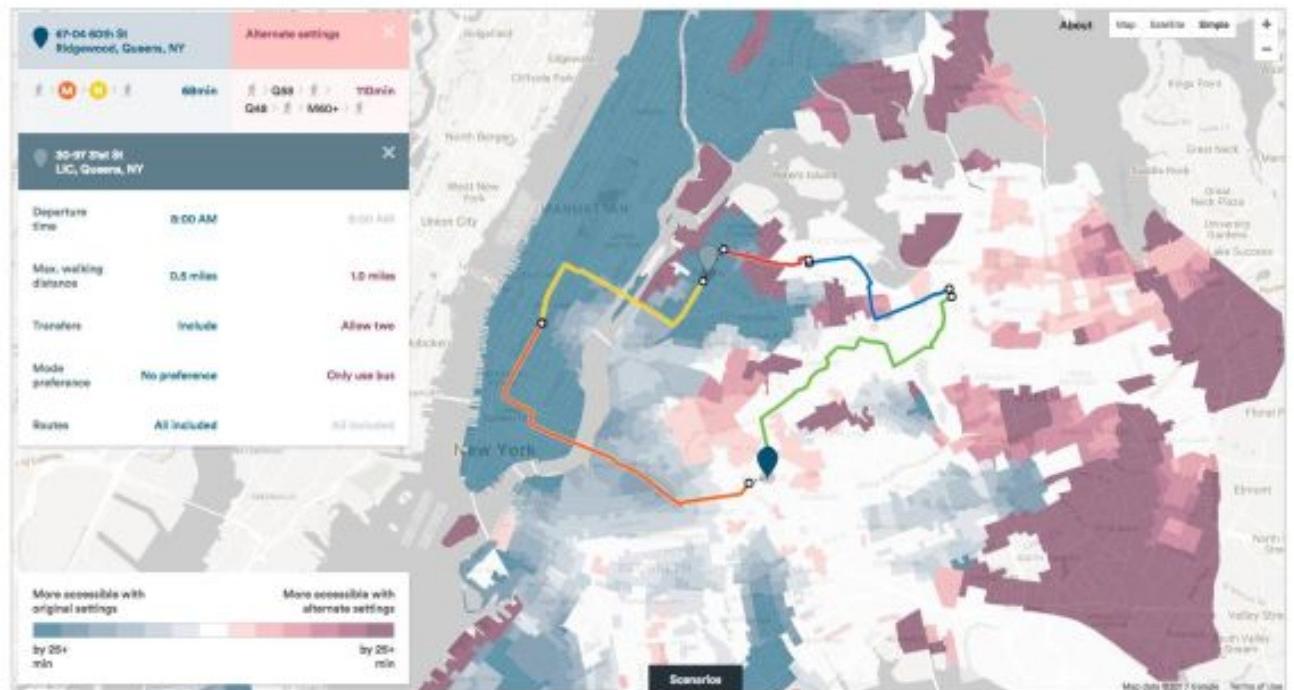
SaaS-based citizen services, applications, and management tools

Step-by-step approach to becoming smarter

Smart cities are enabled by recent advances in key technologies:

- Pervasive sensor networks
- Low-cost communications
- Software-as-a-Service

Transit delays and cancellations – lead to frustrated passengers and over crowded stations



Alerts to users with alternative route calculated on busyness and travel history

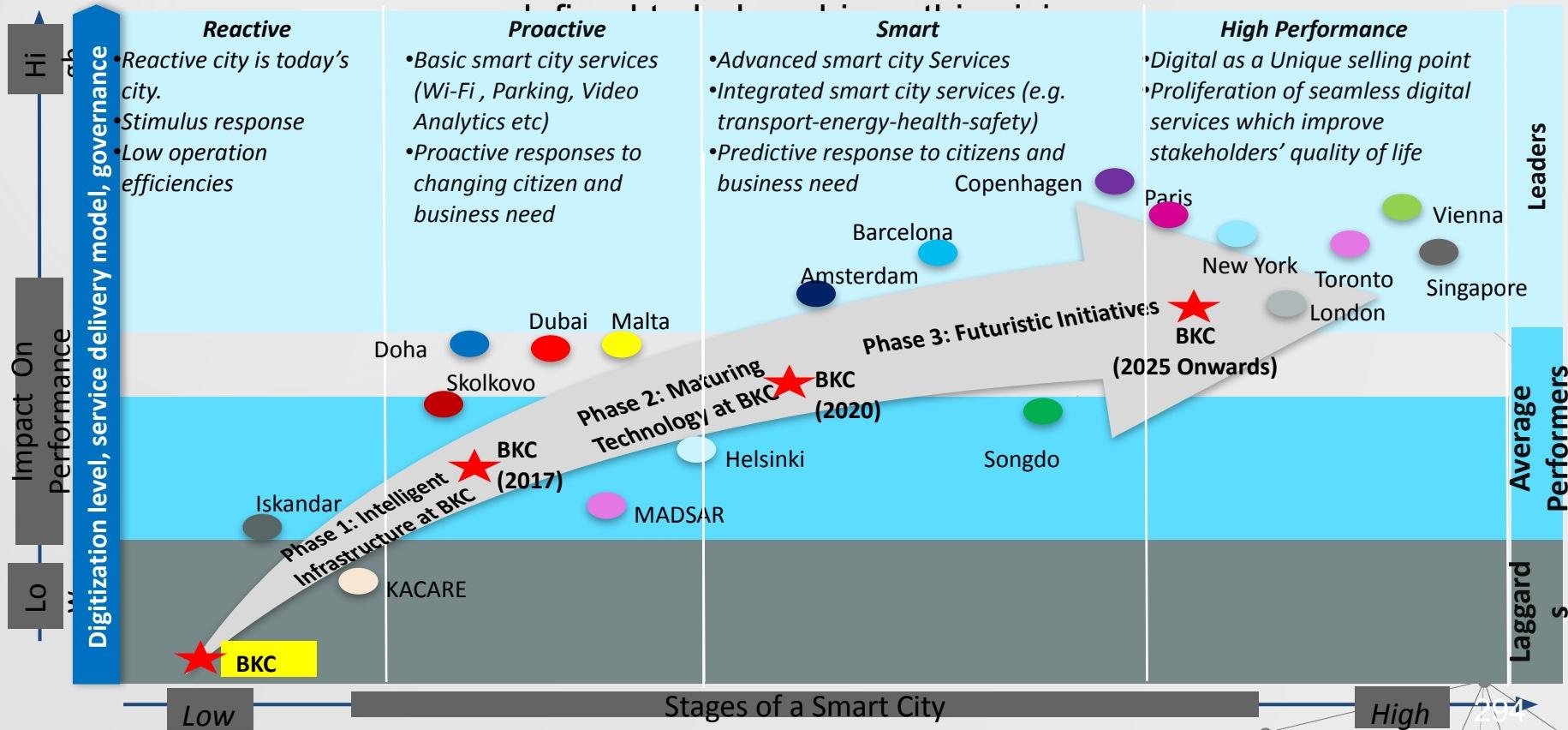


Interactive totems outside the station provide information and alternative routes

Use data to pre-plan alternatives and understand impacts elsewhere
Example: Sidewalk Labs LLC's L line shut down in NY



Based on the various smart cities across the globe,
a smart city Journey for Bandra Kurla Complex is





5 initiatives earmarked for Smart BKC 1.0, Making BKC as a Smart City

1. Public WIFI	2. Smart Parking	3. Smart Street Lighting & Grid	4. Video Analytics & Surveillance	5. Citizen Apps
				
5 MBPS High Speed Wireless Internet Connectivity	3000 Smart Parking Slots	841 Streetlights based on Solar power	Complete E & G Block covered with 90 cameras	33000 man-days saving due to ease of access of information
175 Hectare Area Covered in Public Wi-Fi in BKC	Parking Time Reduced from 20 minutes to 5 minutes	800 tonnes of Carbon Reduced Annually	Greater coordination among Security Agencies	Improves Citizen Communication
Seamless Wi-Fi Connectivity Across E& G Blocks	19000 Liters of Fuel saved annually	Energy Consumption reduced by 40%	Reduced Street furniture theft	Improved Emergency Alert and Response
50,000 man days saved per year	24 tonnes of Carbon Reduced Annually	200KW of Clean energy generated	Improved Emergency Response	6.5 lakhs Employees Covered
Public Wi-Fi as Value Added service for Business and Exhibition Use	Reduction in Unauthorized Parking	Reduced Maintenance Cost	Secured Business Environment	Increase in ease of Business in BKC

Cost Estimates	
• Capex: Rs 19.41 Cr.	• Break Even: 7.38 years
• Opex 1 st yr: Rs 5.51 Cr.	• Total Project Period 10 years
• Annual Revenue generated: Rs 7.91 Cr.	• IRR : 16%

Present Status
<ul style="list-style-type: none"> EOI Received on 02.12.2014 and scrutiny under progress 23 Lead bidders have participated with 2 global consortium and 21 Indian Firms

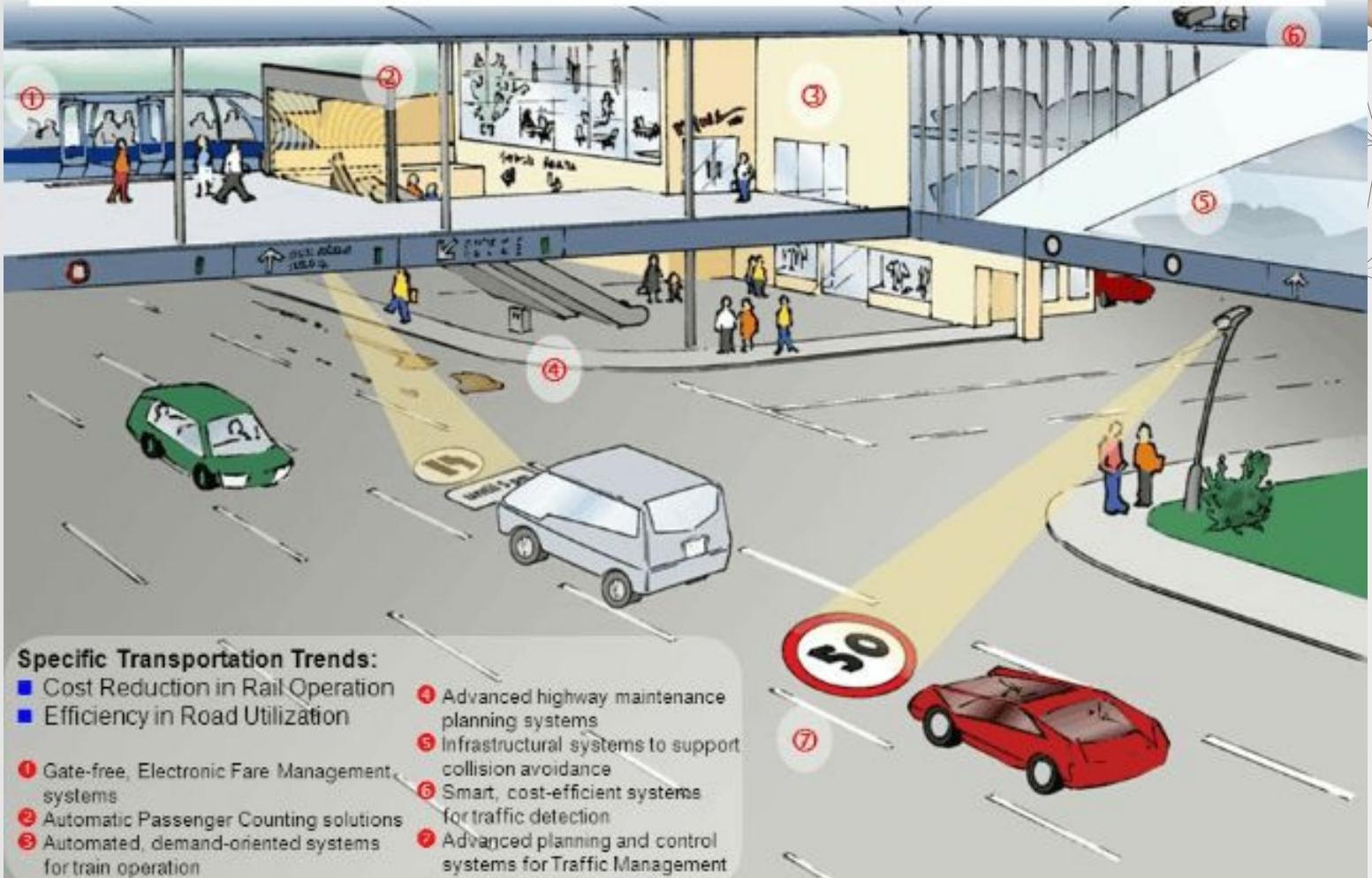


Next Phase Once phase 1 Smart BKC solutions have been implemented additional initiatives can be build upon the existing capabilities as next quick wins



Wi-Fi	Smart Parking	Intelligent Streetlight	Video Analytics	Citizen Mobile Application
<ul style="list-style-type: none">▪ BKC Wide Wi-Fi▪ Communication Backbone for Parking Sensors, CCTVs, Kiosks	<ul style="list-style-type: none">▪ On Street, Open and In Door Parking▪ Parking Guidance App▪ Parking Space Management▪ Parking Reservations	<ul style="list-style-type: none">▪ Lighting▪ Light & Motion Sensor▪ Solar▪ 200 kw Grid Tied Solar PV	<ul style="list-style-type: none">▪ 50 new cameras to cover entire BKC▪ Integration with Mumbai CCTV▪ Command Center at MMRDA and BKC Police St.	<ul style="list-style-type: none">▪ BKC Information▪ Key Contacts▪ Citizen Involvement Mobile App▪ Kiosks
<p>Extend for more Smart City Apps</p> <ul style="list-style-type: none">▪ Air Pollution Sensors▪ Smart Meter (Electric/Water/Gas)▪ Water Quality Meters▪ Flood Sensors	<ul style="list-style-type: none">▪ EV Charging Stations▪ EV Charging Station Locator▪ Differential Parking Charging	<ul style="list-style-type: none">▪ Lighting▪ LED Retrofit Lighting▪ Solar- expand to 1 MW▪ Solar PV on Buildings (Terrace and Façade)▪ Solar PV on Bus Stops	<ul style="list-style-type: none">▪ Extend Command center at MMRDA to City Command Center▪ Feed to Transportation Planning	<ul style="list-style-type: none">▪ Citizen Involvement in Planning▪ Citizen Services -GIS and ERP Integration

Smart Traffic Management Increases Infrastructure Efficiency



Bengaluru

Area Based Development

- **Revitalization Of Historic Heart Of City**
- Infrastructure revitalization (increase in capacity and coverage)- power, sewage system, water supply, Surface drainage, and telecommunication
- The city center needs the highest degree of walkability due to the highest footfall number
- **Integrated Mobility Towards Creating Vibrant Destination**
- Building on Tender SURE and Proposed Metro Station
- Combining Shivajinagar bus depot to Russell Market through an overhead pedestrian bridge
- Reuse of underutilized public area and infrastructure towards economic viability
- **Upgradation & Redevelopment Of Historic Economic Centres**
- Retrofitting of the historic market center through improved public transport connectivity and effective distribution management
- Proficient vending and increased retail footstep through effective space management
- Desegregating the proposed metro station to market through an overhead pedestrian bridge

- **Innovation Of Downstream Clean Up Of Drainage System**
- Green drives for water body clean up
- Improved groundwater recharge
- Creating a lively and accessible public space within the ABD
- **Preservation And Redevelopment Of Centrally Located Parkland**
- Revitalizing the central city through pedestrian connectivity and placemaking
- Desegregate the green network for heritage and cultural places around Kabban Park
- **Increasing Affordable Housing Stock Through Slum Development**
- Upgrading of housing units
- Physical infrastructure – sanitation, street lighting, roads, and water supply
- Social infrastructure – Community Center
- **Health Care Facility Retrofitting**
- Health care center construction redesigned
- Heritage protection of building



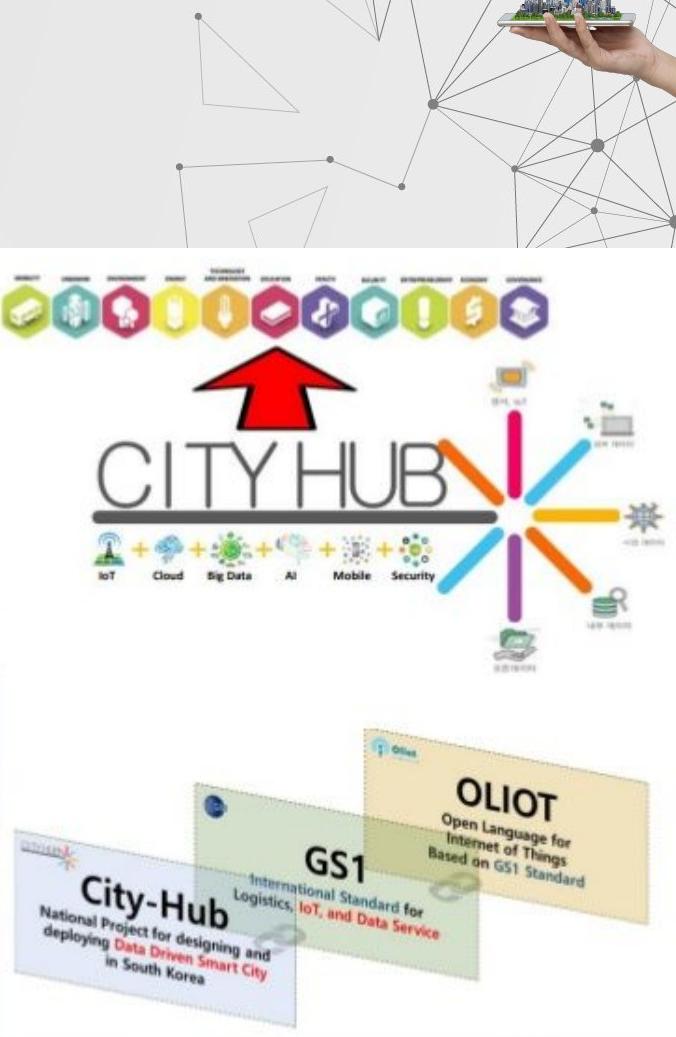
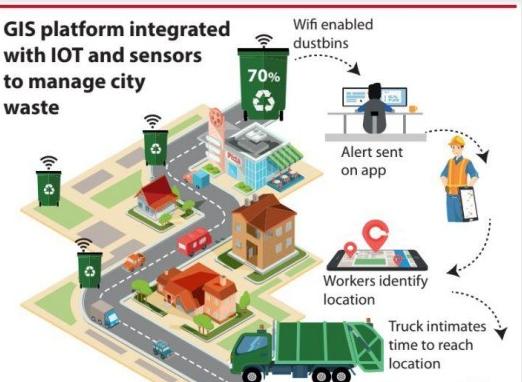
Seoul

Capital of South Korea

Clean up the city,

Recycling bins were linked to computer network ,
that received live updates on the bin's fill level

More efficient collection routines Within 3
months cost cut by 83 %



Songodo city in south Korea

The Korean government has devised a growth strategy Economic by making Korea the business hub Northeast Asia and its transformation into an economy Knowledge-based and service delivery.

This strategy involves creating three Growth poles of reclaimed land, Help create proximity to an airport Incheon

These poles are: **Songodo, Cheongra, and Yeongong**, and they constitute three free economic zones



It occupies the first place in the global ranking of smart cities as the largest city
It was developed using LEED Leader in Energy and Environmental Design In energy and environmental design.

Arrival
Estimation
Service

Traceability
Service

Recall
Service

Nearby
School
Service

Advertise-
ment
Service



Korea, Busan Bus



Spain, Santander Bus

Manufacturing Data
(Parts, Factory,
Manufacturing date)

Registration/
Inspection Data
(VIN, Plate Number,
Reg. Number, Owner,
Inspection Data)

Sensor Data
(Location, Speed,
RPM)

Accident Record
Data
(Date, Location,
Damages)



Barcelona

reducing traffic with s. Parking system,

40 % of traffic is caused by drivers looking for parking spaces.

by installing sensors across the city- use s.phone APP . Live feed

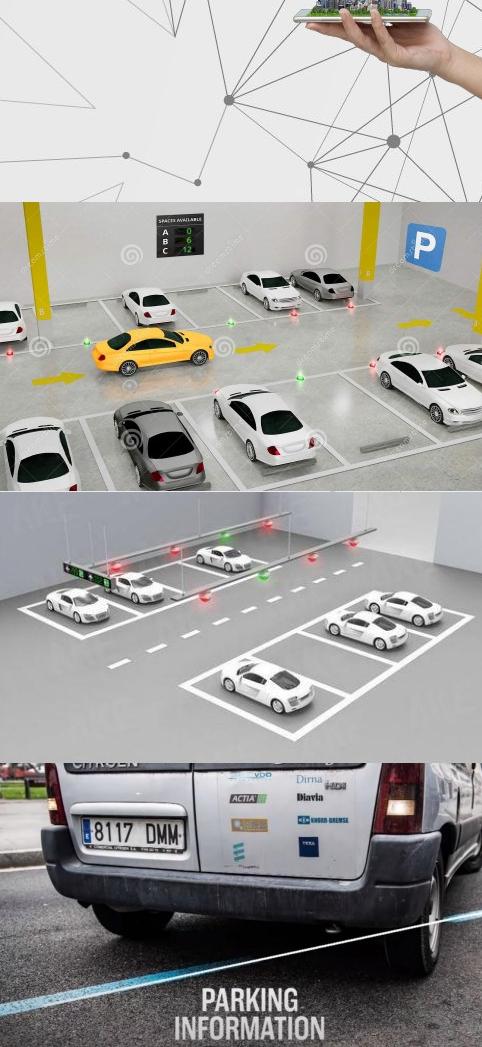
reduced waste time increased better traffic flow . Save environment and petrol , data parking pattern .

Create an ecosystem that industry and academia cooperate under the shared value

- Open various city public data → Drive development of creative smart city services
- Operate data-driven City OS platform
- Based on IoT platforms

How Smart is Barcelona?

- Europe Innovation Capital of 2014
- Mayor Bloomberg Innovation Challenge Winner 2014
- BCN Open Challenge crowdsources solutions for 6 major city problems





Virtual Singapore

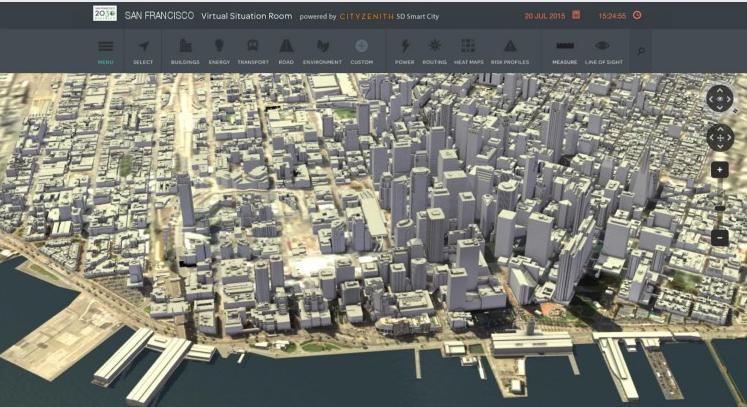


Berlin's 3D City Models



San
Francisco
virtual
situation

Manchester



London

SCOOT traffic system,

online computer monitors live traffic flows from **15,000 detectors**

and **optimizes signal timings** across traffic lights,
has **reduced delays** in the UK capital

Metro

Collect energy while using breaking

Within week – generate energy enough for 2 days operating using one reflector
only .

https://maps.london.gov.uk/lbsm-map/public.html?fbclid=IwAR0FXy2FzfUKdkSE_q-BVbDgTYFzy6SJK-iv-yuPCosnSy65tXAC4CHI4s
<http://www.imactivate.com/>

<https://westyorks-ca.maps.arcgis.com/apps/webappviewer/index.html?id=a186b1f088734f58acaf67e71ba306e>

<https://odileeds.github.io/traffic-growth/>
<https://epc.opendatacommunities.org/domestic/search>



Singapore



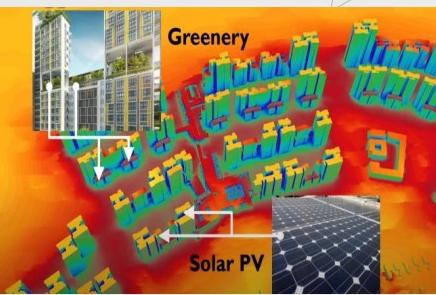
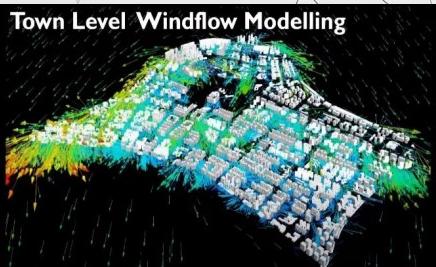
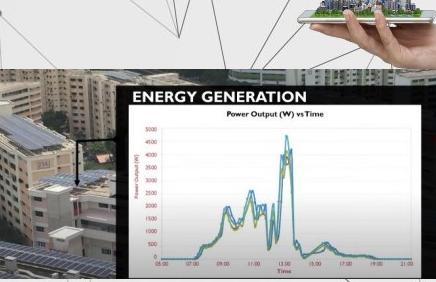
ranked **top** in mobility, health, safety and productivity

smart technology to improve the **flow of traffic**

reduce the number of vehicles on its roads.

smart video surveillance to detect **criminal activity**

and used **digital service platforms and remote monitoring devices** to increase, and improve, access to **healthcare**, particularly among its **older citizens**.



<https://www.sgbike.com.sg/>



CITY FLOW DATA
ASSET TRACKING
SENSOR PLATFORM
DATA CONNECTIONS



Cyberjaya city in Malaysia

The city is 40 km from

The Malaysian capital, Kuala Lumpur, reaches

Its area is about 7000 acres.

It is considered the first smart city in Malaysia . Opening it to be a corporate center International Information Technology

The stages of establishing the city

In the first year: attention was directed to

Facilities and infrastructure design As basic as postal service and methods Access and communications infrastructure.

- In the second year: raising the efficiency of the structure

- IT infrastructure Communications and commercial facilities.

- In the third year: the high quality of the structure IT infrastructure and facilities

- And communications.



City goals

**Make the city an investment center, my favorite
For technology companies with a reaffirmation
On its current location as the prime location
For information and communication technology.**

**Promote an attractive investment ecosystem
Targeted.**

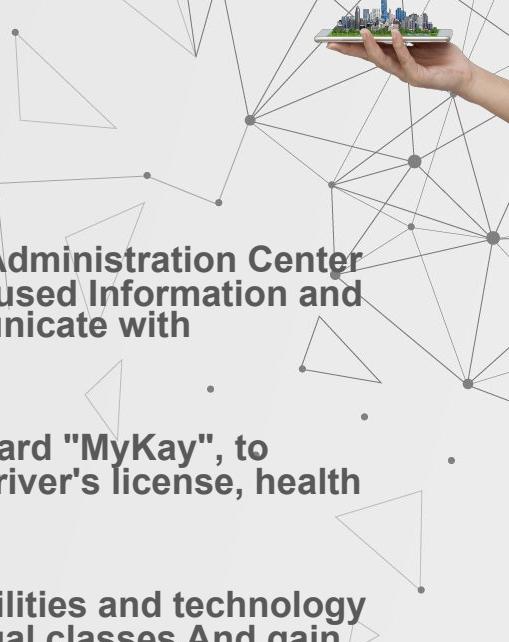
**Encouraging the private sector more
Investment incentives to create
Their companies in this city are exploiting
Information and communication technology.**

**Create high-tech job opportunities
For Malaysians.**



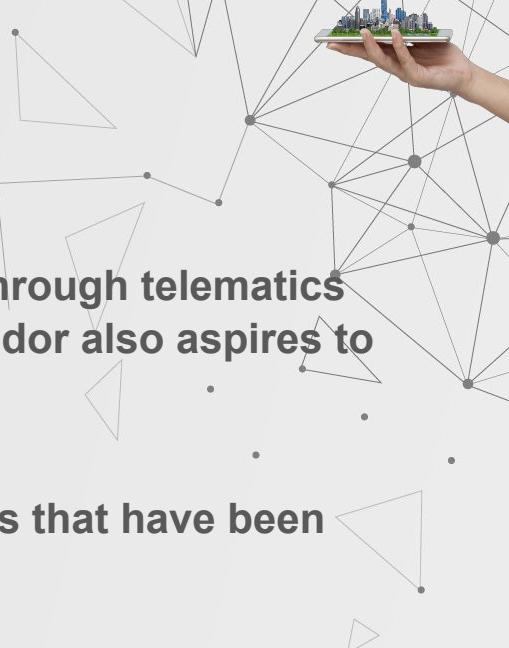
smart applications in the City

- **E-government:** It is the main application and includes the Federal Administration Center in Putrajaya is the main factor in e-government development. It will be used Information and communication technology to allow citizens and businesses to communicate with Government agencies efficiently, and vice versa.
- **World's first multipurpose card:** This project created a smart card "MyKay", to replace your old ID card. It is used like a credit card. ATM bank card, driver's license, health ID card, and card Security identity.
- **Smart schools:** where smart schools are provided with internet facilities and technology Information and communication to allow students to participate in virtual classes And gain knowledge of using technological facilities.
- **Research and Development Group:** includes the development of information technology research and development And communications by encouraging institutions, companies and academic institutes To collaborate in research. Hence, this effort could cultivate generations of Young people in creative information and communication technologies.



smart applications in the City

- **Telehealth:** This project provides healthcare services from: Through telematics and telecommunications. Multimedia Corporation Super Corridor also aspires to be the regional healthcare hub for Distance or telemedicine.
- **E-business:** is to encourage local and international companies that have been established Internet or multimedia business
- **Technology Entrepreneurship Development:** This is a new enterprise expansion project Information and communication technology in the world (small and medium) in Malaysia.



- The city is considered the most expensive city to be built from The private sector worth more than 35 billion Besides, dollars are a landmark Cisco smart.
- Designed and supervised by a partnership between Cisco Technology Advanced International Agent and Morgan Stanley.
- It has adopted high-tech sensors in all buildings And streets to assess and adjust the amount of energy consumption
- The city has wireless communication networks that link all information systems either Whether it is residential, commercial, medical, or government, on the World Wide Web.
- Cisco has prepared connections between every inch in the city and installed devices Electronic sensor on the roads leading to it



"Future technologies form the cornerstone for NEOM's development:

*disruptive solutions for **transportation** from **automated driving** to **passenger drones**,*

*new ways of growing and processing food, **healthcare** centered around the patient for their holistic well-being,*

*wireless high speed internet as a free good called '**digital air**', free world-class **continuous online education**,*

***full scale e-governance** putting city services at your fingertips,*

***building codes** that make **net-zero carbon houses** the standard,*

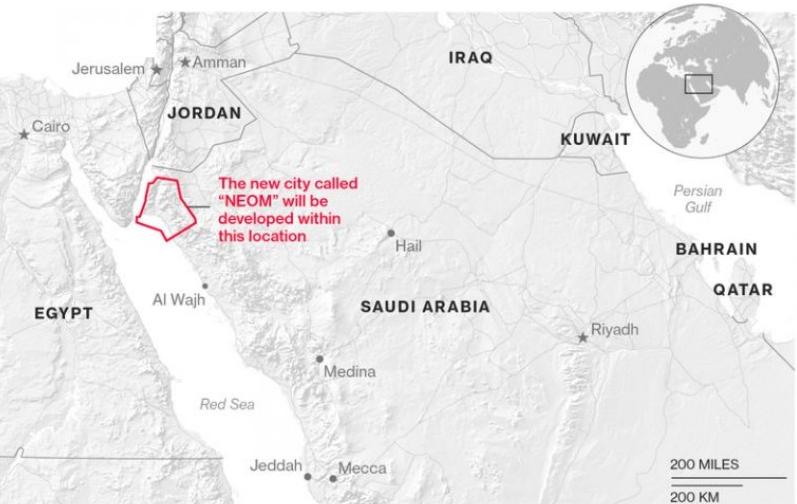
*a city layout that **encourages walking and bicycling** and all solely powered by **renewable energy** just to name a few.*

*All of this will allow for a new way of life to emerge that takes into account the ambitions and outlooks of **humankind paired** with best future technologies and outstanding economic prospects."*

*"We will build the city from scratch," said **Crown Prince Mohammed bin Salman**. "It will be **drone-friendly** and a center for the development of **robotics**. We want to create something different. NEOM is a place for dreamers who want to create **something new** in the world, something extraordinary*

Saudi Arabia's New Mega City

The development will be on the Red Sea coast, and stretch into Jordan and Egypt



Source: discoverneom.com

Bloomberg



saudi arabia unveils THE LINE, a linear development of smart cities connected without cars



WHAT IS THE LINE?

A REVOLUTION IN URBAN LIVING
COMMUNITIES WILL BE FORMED ALONG THE LINE

100%
renewable
energy system

170km
long city of one
million residents

20mins
will be the
longest journey
time end to end

95%
of nature in NEOM
land is protected

HOW WILL THE LINE OPERATE?

Invisible layer of infrastructure

PEDESTRIAN LAYER

SERVICE LAYER

SPINE LAYER

AI-enabled
transport

Ultra high-speed
Transit

Next generation
freight operations

CONGESTION



THE LINE

0%
CONGESTION

THE LINE –
zero cars,
zero streets.

OVER THE PAST DECADE, CONGESTION IN
MAJOR CITIES HAS INCREASED

PARIS

BEIJING

LONDON

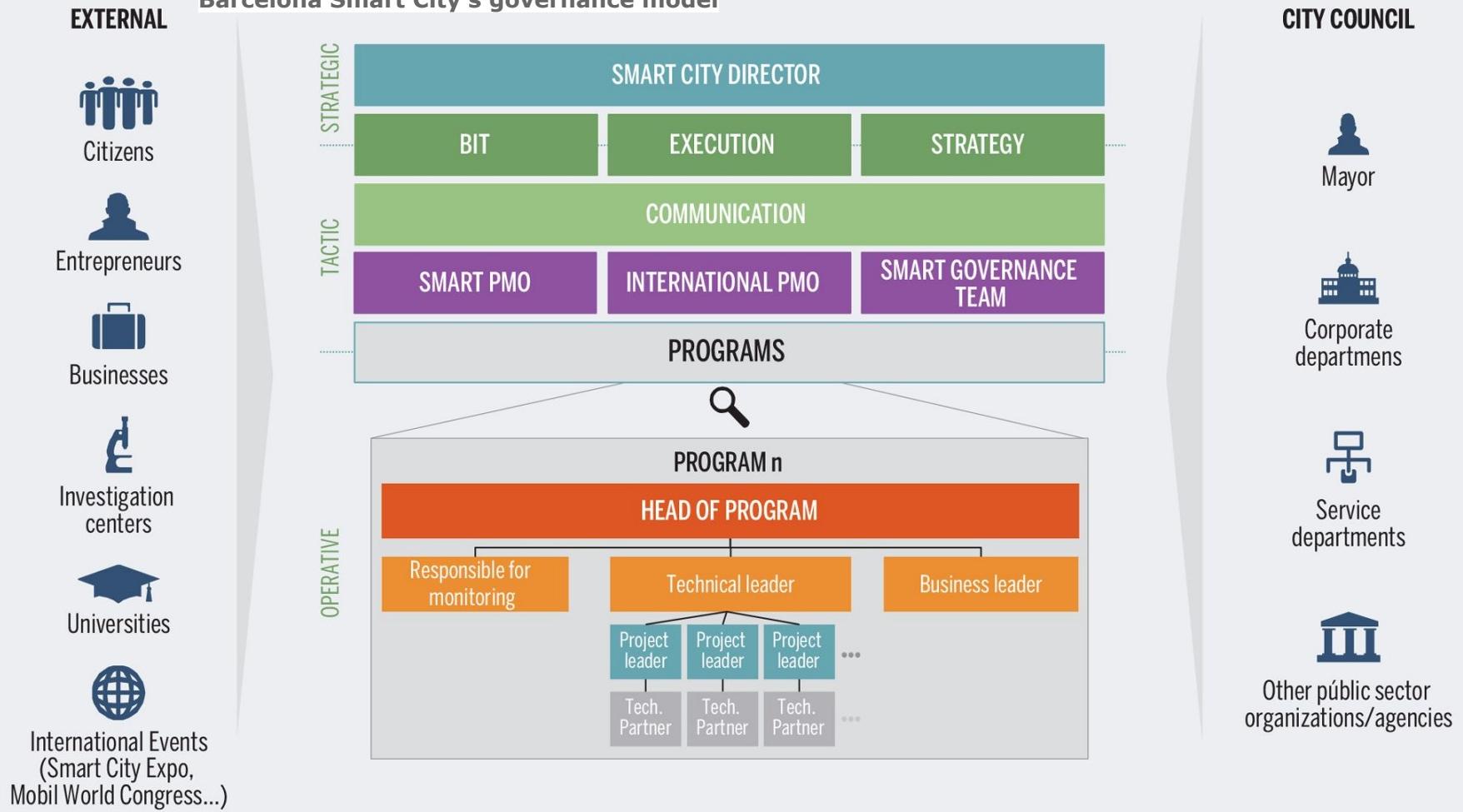
NEW YORK

LOS ANGELES

9% 9% 14% 30% 36%

Drivers in the top 10 most congested
cities lose on average 168 hours per
year due to congestion

Barcelona Smart City's governance model





MASDAR



MASDAR

- Funded by Mubadala Development Company
- Designed by Foster + Partners
- Powered entirely on solar energy and other renewable energy sources
- Zero-carbon, zero-waste ecology
- Abu Dhabi Future Energy Company (ADFEC)
- Projected to cost US\$22 billion
- Started in 2006,
- First phase 2009
- 2.3 sq mi
- 50,000 people
- 1,500 businesses



MASDAR

- Masdar Institute of Science and Technology (MIST)
- Automobiles will be banned within the city
- Public mass transit and personal rapid transit systems
- City will be walled, to keep out the hot desert wind
- Narrow, shaded streets that will also funnel breezes
- Partners include through the Clean Tech Fund, GE, BP, Royal Dutch Shell, Mitsubishi, Rolls-Royce, Total S.A., Mitsui and Fiat



MASDAR

- Power Sources
- 40 to 60 megawatt solar power plant, built by the German firm Conergy (construction activity)
- Larger facility and additional photovoltaic modules will be placed on rooftops to provide supplemental solar energy totaling 130 megawatts
- Wind farms will be established outside the city's perimeter capable of producing up to 20 megawatts
- Geothermal power
- Hydrogen power plant
- The city will not produce enough energy to power itself at night
- Import gas-fired power from Abu Dhabi's grid
- Carbon accounting by exporting excess solar power to the grid during the day



MASDAR

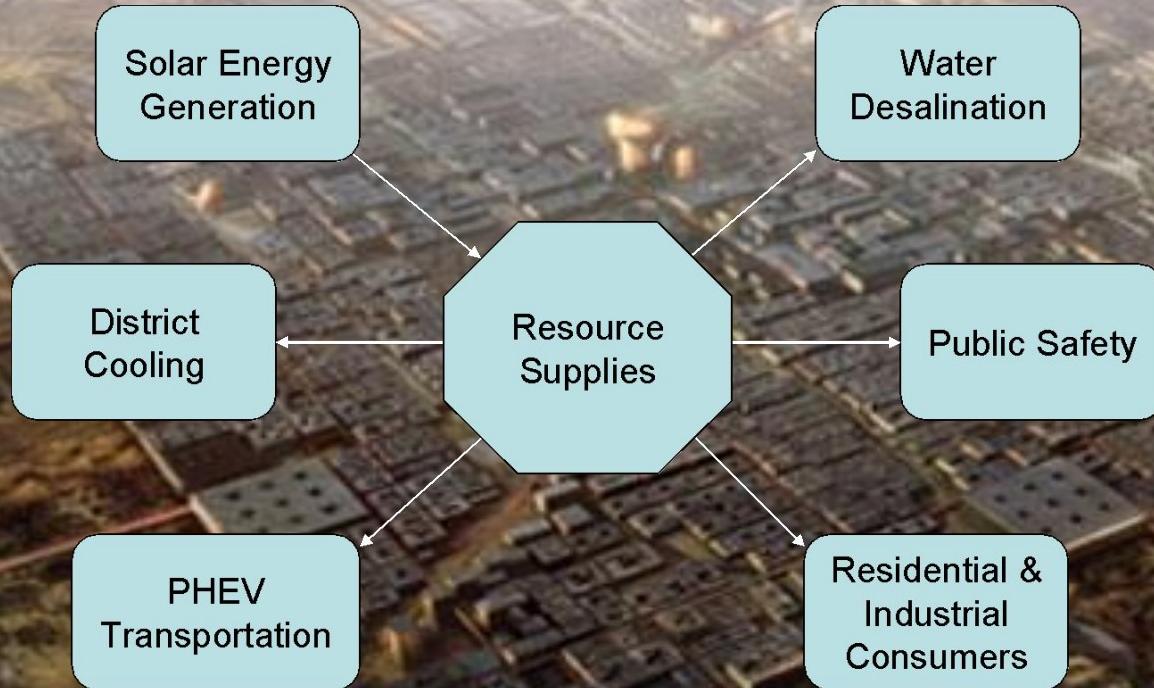
- Water
 - Solar-powered desalination plant
 - 60 percent lower water needs than similarly sized communities
 - 80 percent of the water used will be recycled
 - Attempt to reduce waste to zero
 - Biological waste will be used to create nutrient-rich soil and fertilizer
 - Waste incineration as an additional power source
 - Recycle



masdar-headquarters

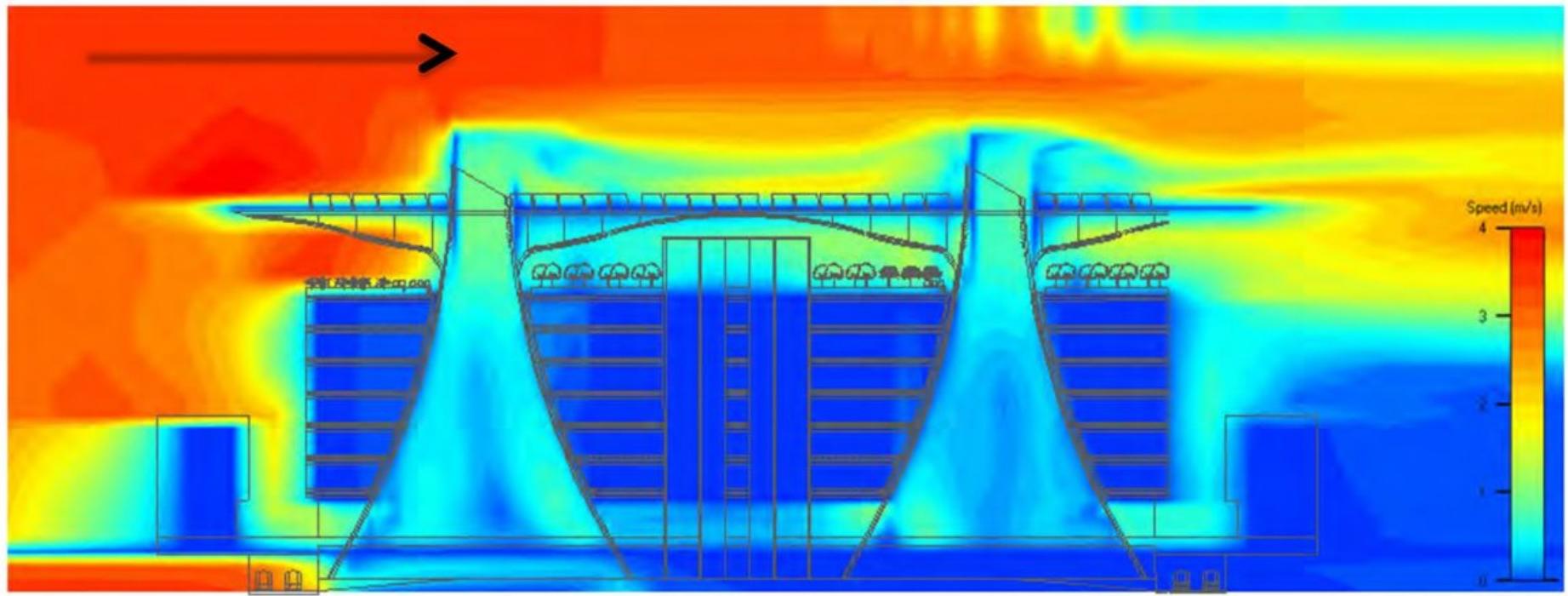


MASDAR – A Net-Zero City (2008)



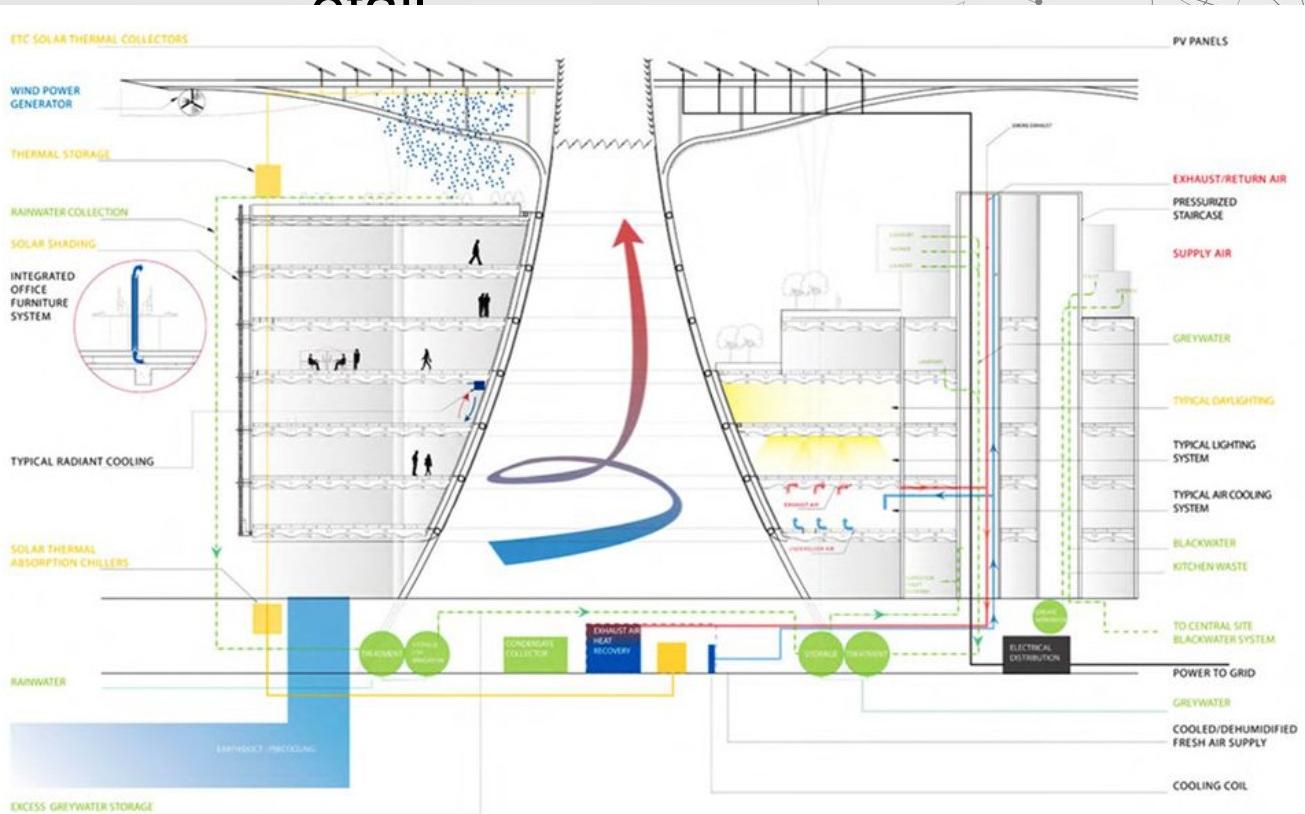
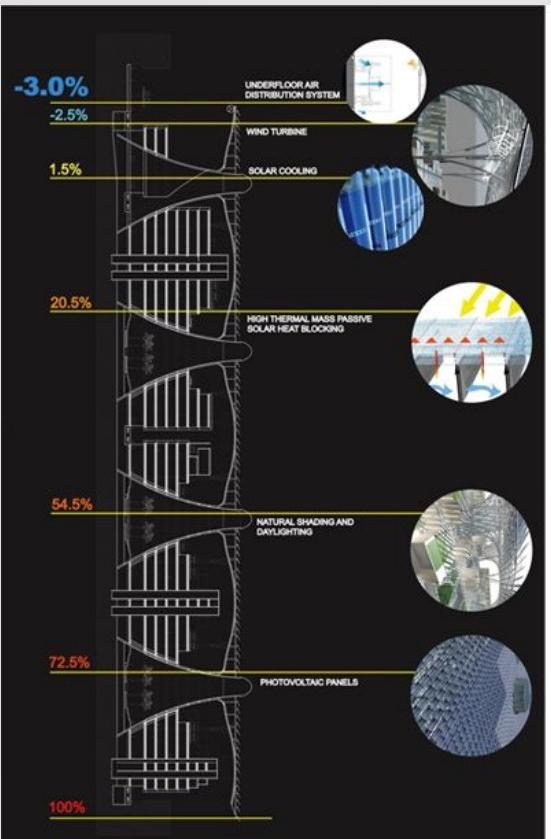
Question: How to allocate resources during a sandstorm?

masdar-hq-ventilation-strategy

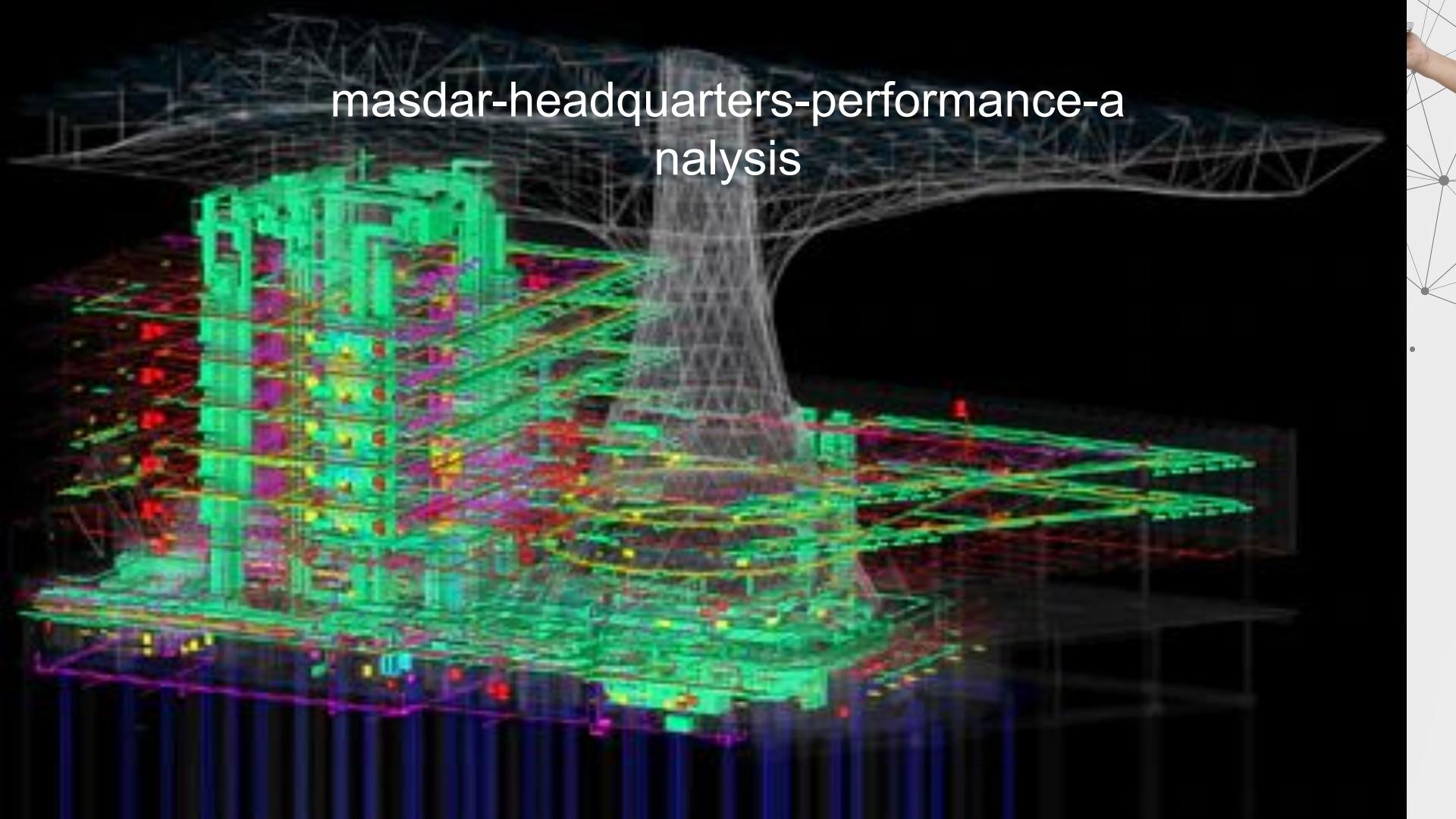


masdar-hq-sustainability-strategies-d

detail



masdar-headquarters-performance-analysis



MASDAR SYSTEMS



- **Building operation**
- Electrical generation and distribution
- Electrical energy meters
- Water meters
- Mechanical systems
- Public health systems
- Lighting control system
- Automated shading system
- Automated atrium roof lights
- Vertical transportation
- Public address system
- Digital signage system
- Sun tracking system
- Irrigation system
- Water features
- Information portal system
- Freight tracking RFID system
- Personnel RFID system
- MASDAR RFID tracking system
- Ventilation system for catering facilities
- Kitchen equipment
- Point of sale system
- Waste system
- Audio visual systems
- Library data base and alarm system
- Automated book storage facility
- **Transportation**
- PRT - Management centre
- PRT - Security system
- PRT - Ticketing system
- Vehicle management system
- LRT - Light Rail Transit System

MASDAR SYSTEMS

- Life Safety and Security
- Seismic monitoring
- Structural anti-corrosion monitoring
- Fire detection/alarm system
- Fire Suppression systems
- Intruder detection system
- Closed circuit television system
- Access control system
- Emergency lighting system
- Oxygen depletion monitoring system
- Refrigerant leak detection system
- Water leak detection system
- Disabled refuge telephone system
- Fire fighters telephone system
- Smoke extract system
- Fire pump
- Sump pumps



MASDAR SYSTEMS INTEGRATION





<https://www.qmic.com/ar/>



A SMART COUNTRY

Safe, Smart Cities



Transport

- 'Blue Road' initiative will reduce 15-20 Degrees of the road
- Smart signals & cameras. Jams less by 10% in 2018



Internet

- 5G launched in May 2018
- First Internet penetration rate in worldwide (99% in 2017)
- The Internet of Things projected to reach \$573 million by 2022



Real Estate

Lusail City

- A \$45 billion smart city infrastructure by 2020

Msheireb Downtown

- A \$5.5 billion smart city infrastructure Occupying 310,000 sm

**INVESTING
\$4.4 B
INTO ICT
SECTOR
BY YEAR 2021**



Healthcare

- 5th in the World in healthcare system in 2019
- \$9 Billion growth by 2020



Education

- Implementing eLearning Qatar maintains highest standards in education.



مِنْتَهَى وَمُعْدِنُ الْمَعْلُومَاتِ
لِلْكُوَادِيَّةِ الْمَعْلُومَاتِيَّةِ
Qatar IT Conference & Exhibition

SMARTCITY
EXPO DOHA

رَئَاسَةِ الْإِسْلَامِ الْأَعْظَمِ
الْمِنْتَهَى لِلْمَعْلُومَاتِ
MINISTRY OF TRANSPORT
AND COMMUNICATIONS

Smart City Examples

- Songdo: <http://songdoibd.com/about/>
- Vienna: <https://smartcity.wien.gv.at/site/en/>
- Berlin:
http://www.berlinpartner.de/fileadmin/user_upload/01_chefredaktion/02_pdf/02_navi/21/Strategie_Smart_City_Berlin_en.pdf
- Helsinki: <http://fiksukalasatama.fi/en/>



Conclusion

We actually don't need Smart Cities.....



We need to
create.....
Smart
Citizens!





**REDUCE
15-30
min/day
ON YOUR COMMUTE**

Intelligent traffic signals
Smart parking

**REDUCE DISEASE
BURDEN BY
8-15%**

Telemedicine
Real-time air-quality info

**REDUCE
CRIME BY
30-40%**

Real-time crime mapping
Predictive policing

**REDUCE
EMISSIONS BY
10-15%**

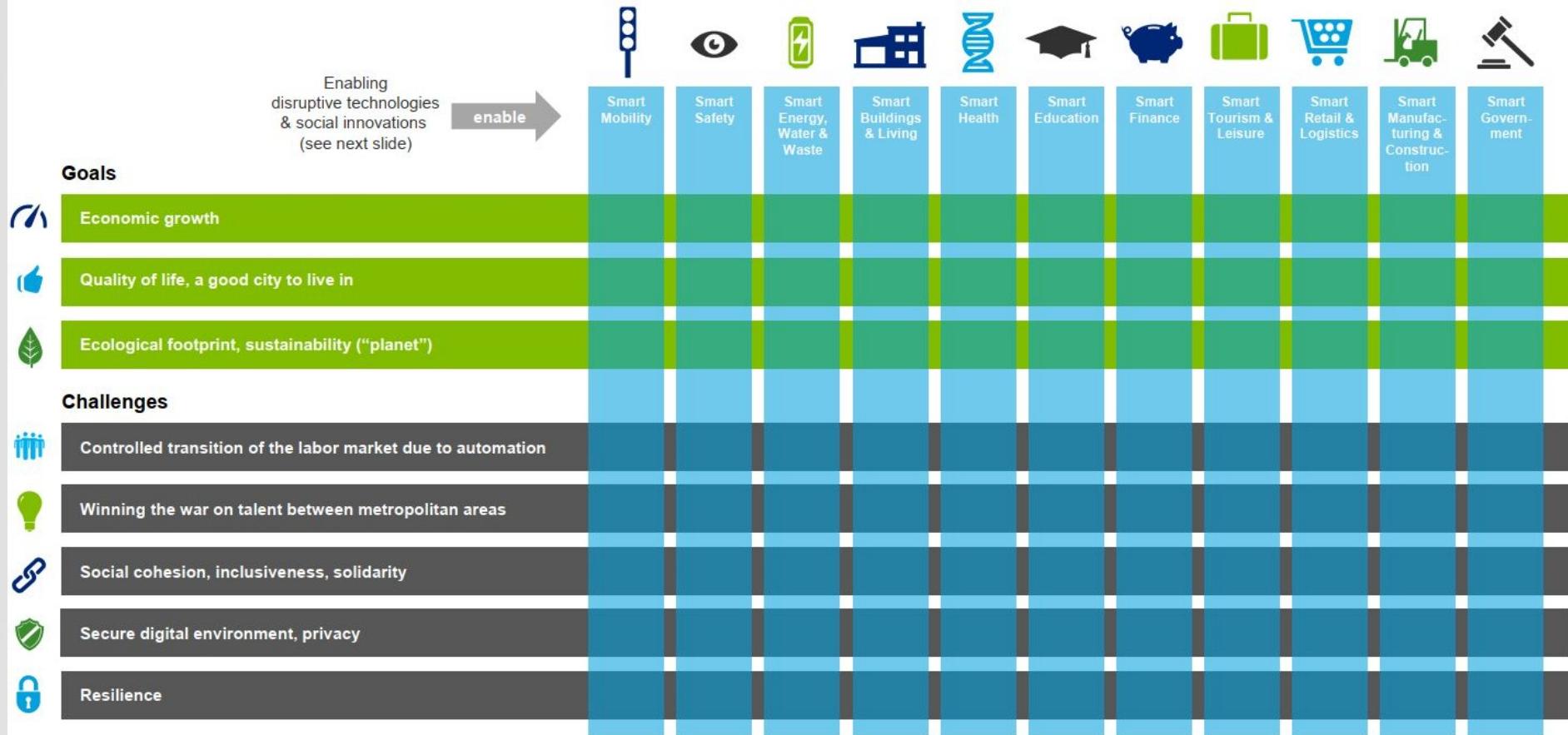
Building automation
Dynamic electricity
pricing

Smart City Standards

- The development of a standard on Smart city terminology (PAS 180)
- The development of a Smart city framework standard (PAS 181)
- The development of a Data concept model for smart cities (PAS 182)
- A Smart city overview document (PD 8100)
- A Smart city planning guidelines document (PD 8101)
- Mapping research and modelling for Smart Cities
- Guidance on the Economic Assessment and Funding of Smart City Initiatives



Smart cities emerge as the result of many smart solutions across all sectors of society







Thank You for attending this presentation



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